Printing Contracts • A Beginner's Buying Guide • Picking a Printer

$2.00

Personal Computing

JUNE 1978

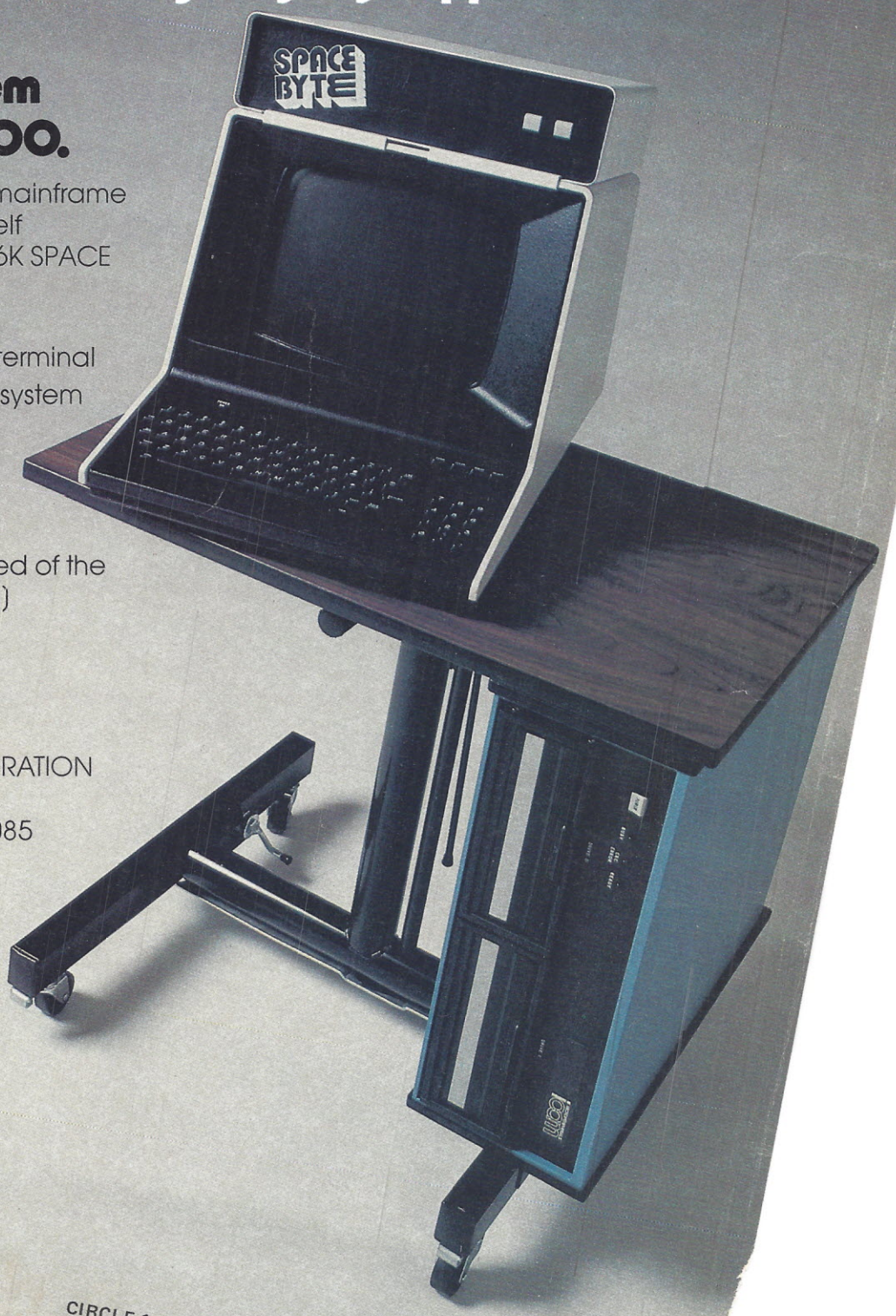


PARTNER MATCHING WITH YOUR MICRO



Introducing the SPACE BYTE™ MODULAR BUSINESS COMPUTER

Complete with assembly language application software



Complete system as pictured $5900.

- SB85-16 terminal mounted mainframe with the SPACE BYTE 8085 self contained computer and 16K SPACE BYTE fully static RAM (48K RAM capacity)
- HAZELTINE 1500 video display terminal
- Dual iCOM flexible disk drive system
- SPACE BYTE Floor stand
- SPACE BYTE "BIZPAK" assembly language disk interactive business application software package optimized by the speed of the 8085 CPU (requires only 16K RAM)
- iCOM FDOS III operating system
- CP/M® disk extended basic and FORTRAN-80 also available

THE SPACE BYTE COMPUTER CORPORATION
6464 Sunset Blvd., Suite 530
Los Angeles, CA 90028 (213) 468-8085

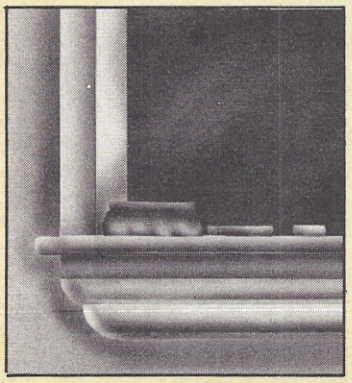
Call for the name of your nearest SPACE BYTE dealer.

CP/M is a registered trademark of Digital Research

CIRCLE 1

June 1978

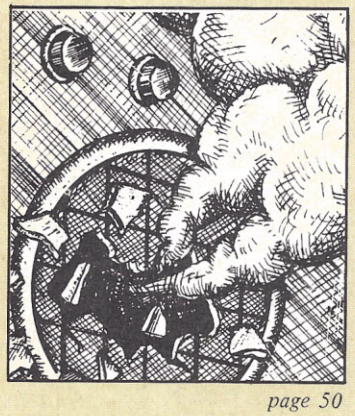
VOLUME II, NO. 6



page 21



page 39



page 50

Cover illustration by Doug Smith
Cover photo by Jon Buchbinder

FEEDBACK 4
RANDOM ACCESS 9
ONCE UPON A TIME 50
COMPUTER CHESS 87
PRODUCT CLOSE-UP 99
WHAT'S COMING UP 101

Cover Story

MATCHING PARTNERS 54
Instead of leaving things to chance, be it Cupid's arrow or names pulled out of a hat, with this program you can match compatible tennis partners, equally talented basketball teams or just two people with the same interests. *by Harriet Morrill*

LAUNCHING PAD

MICROCOMPUTERS IN ONE EASY LESSON 21
Plunging into computer literature can leave the novice as befuddled as trying to read Shakespeare in Greek. This easy-to-understand computer primer explains the basics in simple terms – and includes hints on selecting a system as well.

DIGGING IN

CONTRACT FULFILLMENT 27
Keeping track of which customers fulfill their contracts requires hours of time and complex record-keeping. This program shows how to let your computer do the work for you. *by Sam Newhouse*

PICKING A PRINTER 60
Printers for micros offer a wide range of features, specifications and prices. Here we review these factors to make your selection easier. *by Chip A. Tyeti*

RELOCATABLE ROUTINES 76
Are you tired of writing and rewriting your favorite routines to fit each individual program? You can save needless programming time and effort by using relocatable BASIC routines. *by Robert Irving*

ON THE LIGHTER SIDE

PROGRAMMING THE MOST COMPLEX COMPUTER 26
Learn how to program the most complex computer in the universe – your brain.

FACTOR GAME 44
Sharpen your math skills while having fun with this easy-to-learn game. *by Herbert L. Dershem*

DOT BY DOT 69
You probably played this game back in ninth grade study hall and consistently beat your friends; now you can play against your computer – and lose! *by Fred Helliwell*

MAKING MONEY

PRINTING CONTRACT FORMS 39
With this program you can print contracts for your own business or sell custom-made contracts to local builders, small businesses and contractors. *by Charles A. Matz*

INSTANT REPLAY

INSIDE YOUR MICROCOMPUTER 79
What actually goes on inside a computer? Join us on a guided tour through your micro's innards to find out.



SPACE AGE COMPUTER STORE

New York City and Long Island

If You Want Professional Service
In A Casual Atmosphere –
And A Large Variety of Equipment

BUSINESS APPLICATIONS

General Ledger, Inventory, Accounts Payable, Receivable, Word Processing

GENERAL APPLICATIONS

Northstar Mailing Label Program . . . $45

Northstar Macro Assembler . . . $65

STOCK MARKET PACKAGE – (Unique)

Makes Ticker-Tape Obsolete

Send $2.00 For Descriptive Brochure And Much More

BYTE SHOP

the affordable computer store

130 East 40th Street	2721 Hempstead Turnpike
New York, NY 10016	Levittown, NY 11756
(212) 889-4204	(516) 731-8116
(corner Lexington Ave.)	(Just E. of Wantagh Pkway.)

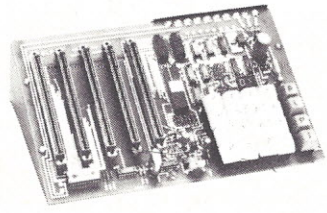
11-7	Tues, Thru Fri	12 to 8
10-5	Saturday	10 to 5

CIRCLE 4

HOBBYISTS! ENGINEERS! TECHNICIANS! STUDENTS!

Write and run machine language programs at home, display video graphics on your TV set and design microprocessor circuits — the very first night — even if you've never used a computer before!

RCA COSMAC microprocessor/mini-computer



A THOUGHTFUL GIFT FOR ANYONE WHO MUST STAY UP TO DATE IN COMPUTERS AND ELECTRONICS!

ELF II $99.95

SPECIFICATIONS

ELF II features an RCA COSMAC COS/MOS 8-bit microprocessor addressable to 64k bytes with DMA, interrupt, 16 registers, ALU, 256 byte RAM, full hex keyboard, two digit hex output display, 5 slot plug-in expansion bus, stable crystal clock for timing purposes and a double-sided plated-through PC board plus RCA 1861 video IC to display any segment of memory on a video monitor or TV screen.

Use ELF II to ... **PLAY GAMES** using your TV for a video display ... **CREATE GRAPHICS** pictures, alphanumerics, animated effects ... learn how to **DESIGN CIRCUITS** using a microprocessor ... the possibilities are infinite!

NOW AVAILABLE

ELF II explodes into a giant when you plug the GIANT BOARD™ into ELF's expansion bus. This powerful board includes cassette I/O, RS 232-C/TTY, 8-bit P I/O and system monitor/editor...meaning your ELF II is now the heart of a full-size system with unlimited computing power! $39.95 kit. $2 p&h.

- 4k Static RAM addressable to any 4k page to 64k. $89.95 kit. $3 p&h.
- Prototype (Kluge) Board accepts up to 32 I.C.'s of various sizes. $17.00 kit. $1 p&h.
- Expansion Power Supply. $34.95 kit. $2 p&h.
- Gold plated 86-pin connector. $5.70 postpaid.

Coming Soon!

Tiny Basic

ASCII KEYBOARD • CONTROLLER BOARD • D-A, A-D CONVERTER • CABINET

SEND TODAY

NETRONICS R&D LTD., Dept. PC 3
333 Litchfield Road, New Milford, CT 06776 Phone (203) 354-9375

Yes! *I want to run programs at home and have enclosed:*

☐ **$99.95** plus $3 p&h for **RCA COSMAC ELF II kit. Featured in POPULAR ELECTRONICS.** Includes all components plus everything you need to write and run machine language programs plus the new Pixie chip that lets you display video graphics on your TV screen. Designed to give engineers practice in computer programming and microprocessor circuit design, ELF II is also perfect for college and college-bound students (who must understand computers for any engineering, scientific or business career). Easy instructions get you started right away, even if you've never used a computer before!

As your need for computing power grows, five card expansion bus (less connectors) allows memory expansion, program debugger/monitor, cassette I/O, A to D and D to A converters, PROM, ASCII keyboard inputs, controllers, etc. (soon to be available as kits). Manual includes instructions for assembly, testing, programming, video graphics and games *plus* how you can get ELF II User's Club bulletins. Kit can be assembled in a single evening and you'll still have time to run programs, including games, video graphics, controllers, etc., before going to bed! ☐ **$4.95** for 1.5 amp 6.3 VAC power supply, required for ELF II kit. ☐ **$5.00** for RCA 1802 User's Manual.

☐ **I want mine wired and tested with the power transformer and RCA 1802 User's Manual for $149.95 plus $3 p&h.**
Conn. res. add sales tax.

NAME_____

ADDRESS_____

CITY_____

STATE_____ ZIP_____

☐ Send info on other kits!

Dealer Inquiries Invited

CIRCLE 5

Personal Computing

JUNE 1978 VOL. II, NO. 6

Publisher/Editor
Harold G. Buchbinder

Assistant Editors
Gary Dozier
Harry Shershow
Ellen Stein
Don Wood

Art Director
Jane Higgins

Editorial Assistant
Marjorie Morse

Product Manager
Charles Verret

Art Staff
Michael Barisano
Stephen Fischer
Barbara Leonard
Richard Sarno

Editorial Production
Sarah Jewler

Advertising Production
Joe Ingram

Composition
Peter Bochner
Donna St. Cyr
Julie Ward
Katherine Willis

Circulation
Regina Harrington
Dave Harriman
Joe Gillis

General Administration
Jonna Yager
Esther Shershow
Marion Pearlman
Sarah Binder
Don Schaaf

Advertising Sales. Northeast: George Palken, Bill Mahan, 1050 Commonwealth Ave., Boston, MA 02215; (617) 232-5470 • **Mid-Atlantic:** Arthur Daks, Benwill Publishing Corp., 69 So. Central Ave., Valley Stream, NY 11580; (516) 872-9550 • **Mid-West:** Hank Bean, 2633 Hillside Lane, Evanston, IL 60201; (312) 475-7173 • **Northwest:** Ralph Petersen, 1380 Oak Creek Drive, Palo Alto, CA 94304; (415) 328-4392 • **Southwest:** Yuri Spiro, Carol Stagg, Benwill Publishing Corp., 924 Westwood Blvd., Los Angeles, CA 90024; (214) 478-3017 • **Japan:** Hiro H. Irie, International Business Corp., 11-8, Narita-Higashi 1-chome, Suginami-ku, Tokyo 166; Phone (03) 445-6111.

Subscription rates. U.S.: 1 year (12 issues) $14; 2 years (24 issues) $26; 3 years (36 issues) $38. Canada & Mexico: add $4/year for surface mail, $8/year for airmail. In Japan/Asia: Personal Computing, c/o CQ Publishing Co., 14-2 Sugamo 1-chome, Toshima-ku, Tokyo 170, Japan. All other countries: add $8/year for surface mail, $36/year for airmail. Send subscription orders and changes of address to: Circulation, Personal Computing, 1050 Commonwealth Ave., Boston, MA 02215. **Back issues.** U.S.: $3. Canada & Mexico: $4. All other countries: $6. (Please remit in US funds – Thank you)

Publisher. Published monthly by Benwill Publishing Corp.: Harold G. Buchbinder, Chairman of the Board; George Palken, President; Esther Shershow, Treasurer. Executive, Editorial and Subscription Offices: 1050 Commonwealth Ave., Boston, MA 02215. Controlled Circulation postage paid at Long Prairie, MN. Membership in Audit Bureau of Circulation pending.

AT THE COMPUTER FACTORY
JUNE IS A VERY SPECIAL MONTH

Act Before July 31st, and you can save between $200 and $900

Just look at these Apple II specials.

VOICE CONTROL

The Apple II, known to date for its unique color graphics, has been party to the most far-reaching computer development of the late 70's . . . ON/OFF VOICE CONTROL.

HEURISTICS and MOUNTAIN HARDWARE, following many years of development, have just introduced low-cost voice-recognition and controller systems — desgined specifically for the Apple II.

The Speech Lab by HEURISTICS . . . complete with board, microphone and programs. Recalls 32 Spoken Words.
Your Apple II can react to your own voice command.

The Introl by MOUNTAIN HARDWARE . . . complete with board, demo tape, and manuals. Ability to control two AC outlets. No extensive wiring needed. Utilizing your own AC lines.

The Computer Factory has configured the Dream System Speech Lab and Introl, alongside your Apple II, gives you a taste of the future, now. Who knows what is next?

SPECIAL

Apple II 16K	$1,145.00
Mountain Hardware	
Control Board	189.00
Introl	149.00
HEURISTICS	
Speech Lab	189.00
sugg. mfg. retail price	~~$1,972.00~~
OUR PRICE	$1,772.00
	SAVE $200

PERSONAL

Our Special Personal System includes AppleII's DiskII. Disk allows quick storage and easy access to files and large quantities of data, for both home and business use. Speeding up load time and data retrieval, the Disk adds flexibility.
For home use, Expandors Impact Printer is undoubtedly the best value on the market today. Full 80 column printer 8½ inch paper (NOT thermal)

SUPER SPECIAL

Apple II 32K	$1,895.00
Disk II mini-floppy	595.00
Printer Interface	180.00
Expandor Printer	425.95
sugg. mfg. retail price	~~$3,095.95~~
OUR PRICE	$2,495.00
	SAVE $600



BUSINESS

There is only one word to describe our business package. VALUE! 48k AppleII Dual Mini Floppy Disks Drives, yielding approx. 200k bytes of stroage. Centronics 779 Printer 80-132 columns 60 cps perfect for all business forms multicopy 5 x 7 dot matrix can be set from 80 to 132 columns.
Just think. A Dual Disk Business System for only $3995. Now that's something special.

SNEAK PREVIEW: Hi-Lo-Close CHARTS FOR APPLEII. Moving Averages To Be Announced July 1, 1978

ULTIMATE SPECIAL

Apple II 48K	$2,345.00
Dual Disk II mini-floppy's	1,090.00
Printer Interface	180.00
Centronics 779 Printer	1,175.00
sugg. mfg. retail price	~~$4,790.00~~
OUR PRICE	$3,990.00
	SAVE $800



ONLY $795

The fully-self-contained Commodore PET Computer System is still ONLY $795.00. Full 8K in RAM, 14K in ROM, full ASCII keyboard, tape drive and 9-inch CRT. Extended Basic is the language, and a machine language monitor is available on tape.

Read from Tape . . . Write to Tape. With PET's 2nd Cassette ($99.95), file maintenance is a breeze.

Now Available! The PET MIMPACT PRINTER . . . ONLY $595.00 . . . 120 cps. . . 8½inch paper . . . YES, it will print the PET's

ATTENTION PET OWNERS

Programs are now available for the Commodore PET 2001. The Computer Factory, through NCS, has now released software for personal financial management. The following programs are now available:

MORTGAGE ($15.95)
CHECKBOOK ($15.95)
FINANCE ($12.95)
OPTIONS ($24.95)
ANNUAL REPORT ANALYZER ($22.95)
STOCK ANALYZER ($34.95)
DATA BASE ($175.00)
BONDS ($9.95)

THE COMPUTER FACTORY

790 MADISON AVENUE, NEW YORK, NY 10021 (212) 249-1666 or (212) PET 2001 T-F 10-6 SAT. 10-4

CIRCLE 6

FEEDBACK

Tax Fullfillment

Dear Editor:

Last month I reluctantly renewed my subscription to your magazine – then I read Joe Roehrig's tax article in your March issue.

Please, please, please tell me how to contact Mr. Roehrig concerning his program. His article alone makes your subscription rate worthwhile. Of course, your many fine articles contribute to *PC's* worth, but "Taxes" fills my needs. Thank you.

Charles Tyzzer
Account Manager
Tipp City, OH

Editors note: Joe Roehrig's address is: P.O. Box 74, Middle Village, NY 11379.

Tax Amendment

Dear Editors:

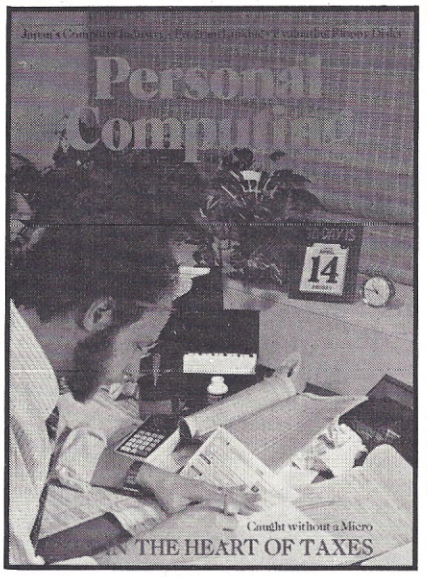
I just received the March copy of your magazine and the first article I read was Mr. Roehrig's "Deep in the Heart of Taxes". I don't know if the program works; however, I did notice a couple of errors which could get the user in trouble with Uncle Sam if it were used as currently written.

Regarding the dividend exclusion calculation, not all dividends are eligible for this exclusion nor does a married couple automatically get a full $200.

Both husband and wife get $100 each to be applied against their individual dividends. If only one has dividends, the exclusion is limited to $100. If one has dividends under $100, that partner's exclusion is limited to the amount of the dividend.

This exclusion applies only to qualified dividends, of course. Non-qualifying dividends must be reported at their full amount. This calculation would require a complete sub-routine to be calculated correctly.

In the Schedule A, Medical Deduction, Line 1 should contain one half the insurance premium up to a limit of $150 with the balance to be listed on Line 5. This would also require an extra calculation to divide the total amount of the premium into two separate amounts and list them on the correct lines.



Although not an error in the program, in Mr. Roehrig's example he deducted Excise taxes. This is a non-deductible item which an auditor would be sure to notice – so I wouldn't advise following his example.

An Income Tax program would be an useful addition to anyone's program library; but it would have to be created by someone with a better understanding of the income tax laws than Mr. Roehrig shows.

Phyllis J. Coddington
Blythe, CA

Printer Info

Dear Editor:

In the "Future Computing" article, March '78, page 82, the author refers to several printers. I want to get a printer for use with my Heath H8 and one or more of these sounds good.

I would appreciate any information (or addresses) on Centronic Micro-I, Integral Data Systems and the Exorciser.

Tandy Computer's catalog advertises "Practical Automation DMTP-6". Information or address here would also be appreciated.

Jim Crossman
Alexandria, VA

Editor's Note: Funny you should ask. See our article on printers on page 60. It shows not only what's available, but what works well with what, price, availability, speed, MTBF *and* MTTR, *print mechanism, physical and mechanical specifications and lots of photos of the ins and outs of these devices. The chart, text and photos should save you hours of searching and evaluating printers by other means.*

Tools of the Trade

Dear Editors:

The article "Computer Languages: Tools of the Trade", which appeared in the March '78 issue, was especially interesting to me. As a rank newcomer to the microcomputer scene, I found this article especially helpful in providing some explanations of the application potentials of several computer languages.

I've seen the languages mentioned in various literature, but knew nothing about them until now.

My thanks to the author for the understandable enlightenment and to you for printing it.

Tom Swalenberg
Columbus, OH

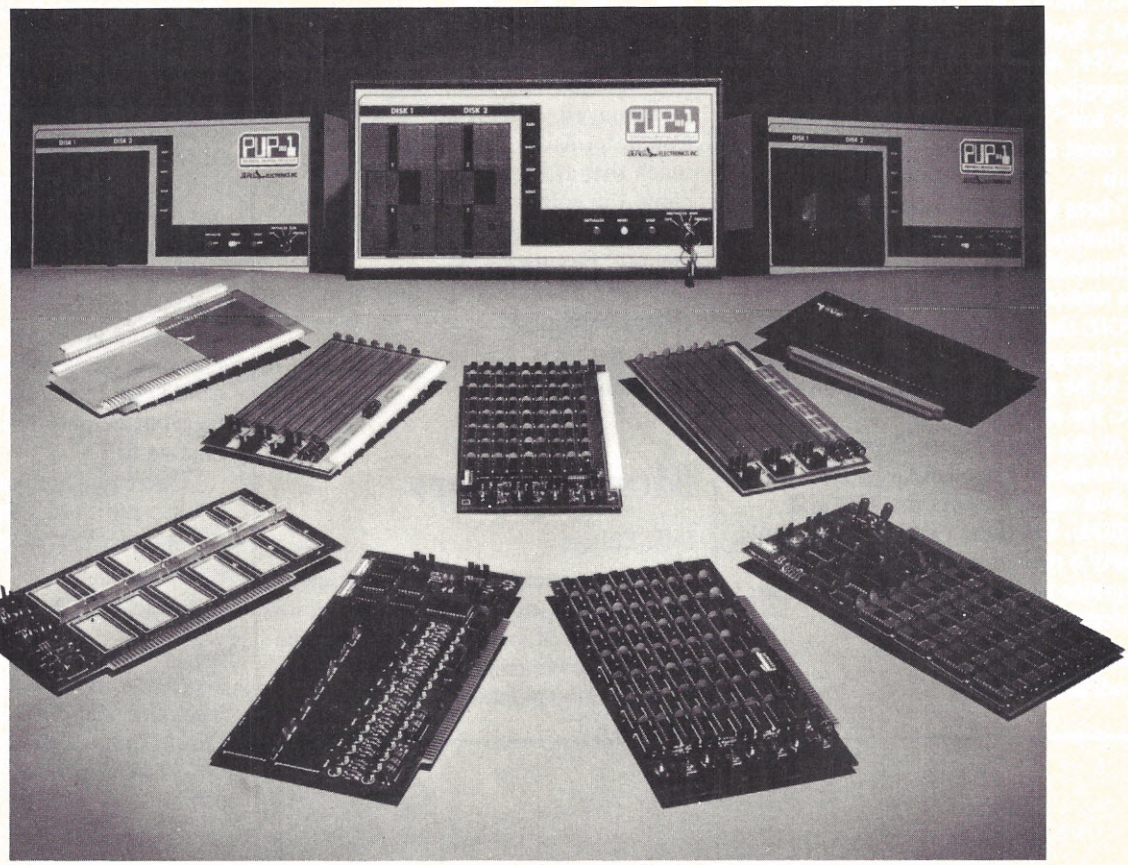
* * *

Dear Editors:

Your article, "Computer Languages: Tools of the Trade", in the March issue of *Personal Computing* could not have been timed better for me! I am from a mainframe/minicomputer background steeped in RPG and COBOL. Languages like PASCAL and FORTH were Greek to me, though I've recently become very interested in the use of micros in the office.

One language you did not mention is RPG (or more correctly today, RPGII). It has become the most widespread commercial language among the

What you should know about the Seals Retail Program.



The performance-packed family of Seals products featuring (lower left to right) BBUC, 4KROM, 8KSC, 16KSC, (middle left to right) 68EXT large and small, 68WWC, 68KSC, 88WWC, 88EXT (top) PUP-1 computer.

At Seals Electronics we believe in specialization. We concentrate on manufacturing a reliable line of microcomputer products so that you, the retailer, can concentrate on sales.

When you are a Seals dealer you can depend on Seals for:

- Dependable, quality hardware with an industry wide reputation for excellent performance.
- A marketing program designed to support you at the point-of-sale.
- Price margins that give you the best possible advantage and recognize that you need profits to operate.
- A staff of marketing and technical specialists who are interested in you and your business.

The people at Seals have been in the microcomputer business for a long time. We know that the computer retailer needs and deserves the very best possible support from a manufacturer. We are constantly on the alert to improve our retail program. Seals works with you to increase your sales and assure you satisfied customers. We don't ask that you be a manufacturer (all our products are available assembled and tested) and we know you don't want us to be a retailer.

The 1977 Computer Store Survey published by Image Resources gave Seals Electronics consistently high ratings in the areas of product image, value to customers (product reliability and documentation), and dealer interface with manufacturers.

We are proud of our record with retailers and are working hard to improve our position in the industry. We would like to work with you.

For current literature on the Seals microcomputer product line and/or more information on our retail program, call or write our Marketing Department, Seals Electronics, 10728 Dutchtown Road, Concord, TN 37922, (615) 966-8771.

Dealer support is more than just words to us.

SEALS ELECTRONICS
INCORPORATED

CIRCLE 7

minis, mainly due to the influence of IBM's System/3, System/32 and System/34. As you no doubt know, most competing vendors have added it as a "me too" feature, so that today it's the most common language uniting the minis.

There is a heavy investment in RPG applications programming, and notwithstanding the admitted drawbacks of a non-procedural language like RPGII, the sheer weight of working RPG programs in small businesses has got to be exacting some pressure for an RPG for micros.

At the recent Micro Business '78 conference in Pasadena, I heard nothing but vindictiveness for RPG and COBOL. Yet these two languages could supply a ready inventory of mature programs for the very audience of that conference.

Dennis A. Fletcher
Woodland Hills, CA

Took the Plunge

Dear Editors:

I enjoyed your article "Diving into Computer Advertising" (March '78) so much that after reading a borrowed copy, I'm going out and buy my own copy so I can use the article and the one on "Floppy Facts".

Both should prove invaluable in buying equipment.

Frank Schickel
San Francisco, CA

More memory

Dear Editors:

I have just ordered a Radio Shack TRS-80 computer. I would like to know if you know of any way to increase the memory by plugging in the RAM chips sold by many manufacturers. Is this all that is necessary to increase the memory?

If it is that simple to add memory, I am sure that your readers would be glad to know that an extra 8K could be added for about $20.

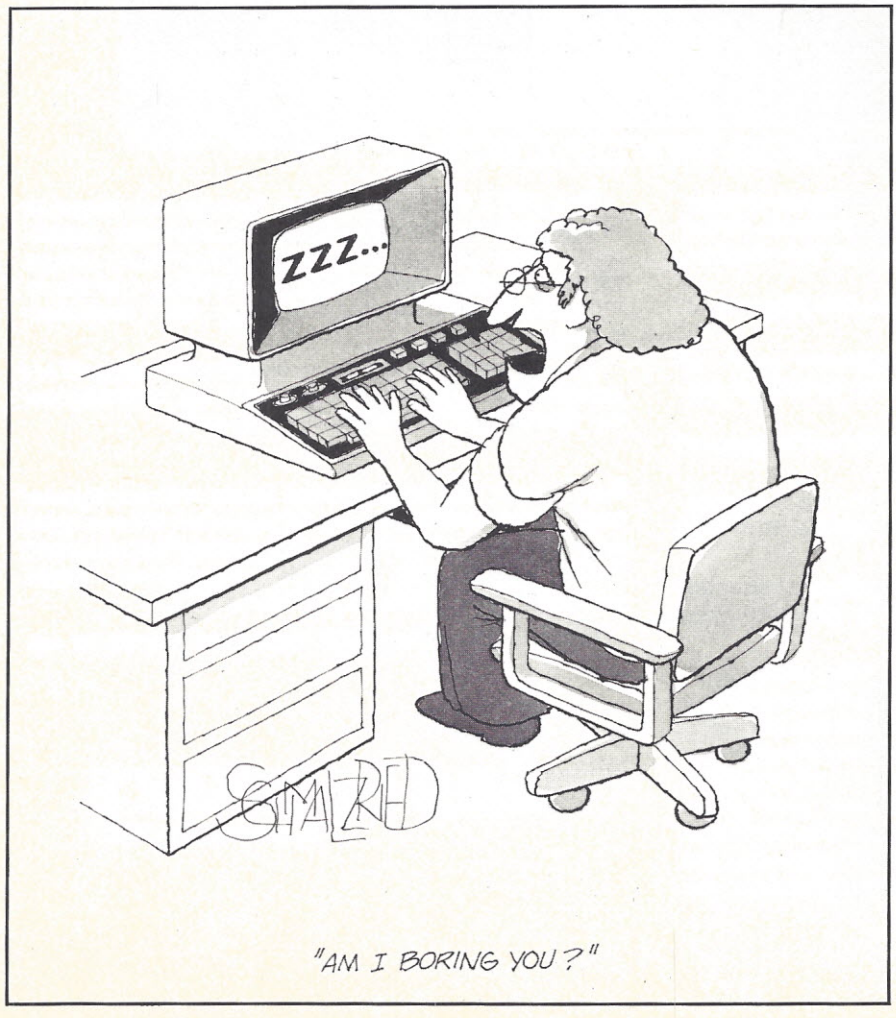
I assume that Radio Shack has built the computer so that more extensive alterations are required, but I have been told that the sockets are in place for the expansion.

I would appreciate your answer. As I know nothing about hardware, it would would also be helpful if you could tell me what number RAM chip I should be looking for.

Thank you and keep up the great work – Purinton's article on encoding messages was fabulous.

Bill Lapper
Los Angeles, CA

Editor's Note: Increasing memory by plugging in RAM *chips is not as easy as it sounds. Yes, there is more to it. Check Radio Shack's expansion interface (26-1140) for $299. You might be better off.*



Waiting patiently

Dear Editors:

Your February issue of *Personal Computing* has a mistake on page 46. You list Ohio Scientific as having an availability of 2 (1-2) months. I ordered mine on October 19, 1977, and have not yet received it (March 20, 1978).

RR Eddins
Dothan, AL

Programs for programmables?

Dear Editors:

In his article on programmable calculators in the November/December 1977 issue of your magazine, James Pittman referred to a "Star Trek" program for programmable calculators.

Is this program available to the general public, and if so, where?

Michael Katz
Kansas City, KS

Author's Note: I'm sorry to say that the "Star Trek" program for the HP-67 and HP-97 programmable calculators is not, to my knowledge, available to the general public.

The program I referred to in my article was written by Hal Brown and appeared in 65 Notes, *Vol 3, No. 10, p. 21, December 1976. A couple of errors in this program were noted and corrected in the July/August 1977 issue, Vol 4, No. 6, p. 1.*

65 Notes *was the monthly newsletter of the international HP-65 Users Club which was formed in June 1974 to support the Hewlett-Packard HP-65, the first programmable pocket calculator. In January 1978 the name of the organization was changed to* "PPC" *and that of the newsletter was changed to* PPC Journal *to better reflect the fact that the club supports all Hewlett-Packard programmable calculators, not just the original HP-65. Back issues of* PPC Journal *and* 65 Notes *are available to members only.*

Users' clubs are potentially of great value to owners of personal computing systems. A current programmable calculator such as the HP-67, HP-29, TI-58 or TI-59 is so powerful and so versatile that it cannot be adequately supported by the manufacturer's owners manual.

A users' club shares member-supplied interdisciplinary programs as well as news about the latest available machines, pictures and descriptions of the circuits and construction of calculators, suggestions for modifications to make to calculators and information on "unsupported" features of calculators that the manufacturer either doesn't know about or doesn't want to talk about.

I suggest your joining a users' club such as PPC. *A self-addressed envelope with postage for 2 oz., first class mail will bring a 12-page special issue of reprints from back issues of* PPC Journal/65 Notes. *I don't know for sure, but I suspect a similar request to the SR-52 Users Club, with a SASE, will bring a sample newsletter from that organization.*

The addresses are: Richard Nelson, Editor, PPC Journal, 2541 W. Camden Place, Santa Ana, CA 92704. And, Richard Vanderburgh, Editor, 52 Notes, 9459 Taylorsville Road, Dayton, OH.

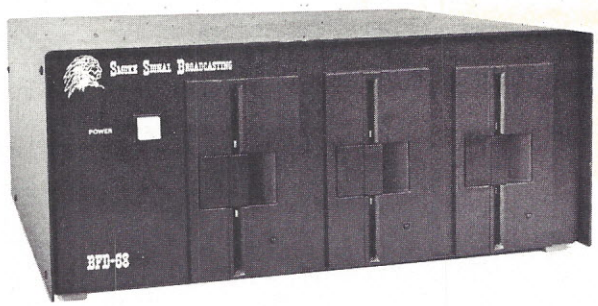
As ever more powerful pocket calculators are introduced, I believe users' organizations will become even more important to people who wish to fully take advantage of and more fully understand their computing capabilities.

– James Pittman

Comments, questions criticism are welcomed

All letters should be sent to: *Personal Computing*, 1050 Commonwealth Ave., Boston, MA 02215.

"OLD RELIABLE"



BASIC FLOPPY DISK SYSTEM

- RANDOM ACCESS FILES
- ANY NUMBER OF FILES MAY BE OPEN (IN USE) AT ONE TIME
- THE NUMBER OF FILES AND SIZE OF FILES IS LIMITED ONLY BY THE SIZE OF THE DISK
- MERGING FILES REQUIRES NO EXTRA DISK SPACE
- NO WAITING FOR THE DISK TO RE-PACK
- LONGER DISK LIFE—MORE EVEN DISK WEAR

We delivered our first mini-floppy disk system a year and a half ago – 6 months ahead of any other 6800 based mini system. Since that time, it has earned the reputation of being the most reliable mini-disk system available.

This system comes completely assembled with a disk controller that is plug compatible with the SWTPC 6800. In fact all our products use the 6800 standard SS-50 (Smoke Signal 50) bus used by SWTPC. The cabinet and power supply are capable of handling up to 3 Shugart Mini-Floppy Drives. One drive is included in the price of the BFD-68 and others may be added easily at any time. Or you may save money by ordering the dual-drive BFD-68-2 or triple drive BFD-68-3 (pictured). Price: BFD-68 $795, BFD-68-2 $1139, BFD-68-3 $1479, SA-400 Drive $355.

A bootstrap PROM is included on the controller board to initiate the Disk Operating System. Thus, you can be up and running from a cold start in just a few seconds.

SUPER SOFTWARE

The BFD-68 includes our new expanded disk operating system and disk file handling BASIC interpreter. In addition, the BFD-68 is supported by the most complete microcomputer software available today. This includes an excellent editor and text processor, several assemblers and a BASIC compiler.

Send for FREE NEW Computer Products Catalog

SMOKE SIGNAL BROADCASTING

6304 Yucca/Hollywood, CA 90028/(213) 462-5652

CIRCLE 8

Introducing the world's first intelligent HARD DISK CONTROLLER

Specifically designed for microprocessor based systems

Hard disk storage from 5 megabytes to 1.2 billion bytes for the S-100 OEM



- Z80 Intelligence provides CPU decision-making power.
- CreaComp uses the concept of shared memory to free your host for other tasks while disk I/O is being performed, enhancing a Multi-User environment.
- Multi-User/Multi-Tasking operating system
- BASIC compiler provided

CREA/COMP SYSTEMS, INC

(516) 585-1606
TWX 510-228-1097

4175 VETERAN'S HIGHWAY
RONKONKOMA, N.Y. 11779

Contact your local dealer or CreaComp Systems, Inc.

CIRCLE 9

RANDOM ACCESS

In the dark?

After last summer's New York City blackout and subsequent problems, no one's taking any chances. Florida Power & Light Company (FPL) has even installed a computer-based power network simulator to train operating personnel in the prevention and handling of emergencies in order to avoid major power outages.

Called a Control Data Dispatcher Training Simulator (whew!), the $200,000 training system is similar to the cockpit simulators used in the aircraft industry. It is designed to provide "hands-on" training for power system operators, especially under abnormal or emergency conditions.

Simulated problems are presented on a seven-color CRT linked to a Control Data CYBER 18-17 computer, which simulates the power system. Problems are presented as though the operator were supervising the actual FPL



system through a real communications and control system, with the operator expected to take corrective actions as quickly as possible.

System operators, power coordinators and system dispatchers — people responsible for controlling the system — periodically will undergo training on the simulator to practice avoiding and recovering from abnormalities.

FPL officials believe the simulator will improve reliability of their system and decrease the possibility of a major outage.

The system can be programmed to simulate difficulties with power plants, transmission lines and substations in virtually any combination, and it also can be used to perform tests on proposed FPL facilities under simulated operating conditions prior to construction.

So now, Floridians can not only forget about snow, but they can forget about stocking up on candles and flashlights as well.

Computer programming certificate

551 candidates took an examination in late October, 1977, at 99 testing centers in the U.S., Canada and abroad. A total of 213 (39%) passed the examination. And recently, the offering of the Certificate in Computer Programming (CCP) was declared a success by William W. Cotterman, Chairman of the CCP Certification Council.

"The examination is sound technically," Cotterman said in reference to demographic and psychometric studies made by the Psychological Corporation in New York who administer the CCP examination.

The first steps in the development of the program designed to recognize the senior-level programmer began with an ad hoc committee established in 1976 by the Institute for Certification of Computer Professionals (ICCP).

As the examination evolved, it was determined there was a common core of knowledge used by programmers in most settings which could be tested on a general examination.

In addition, three major areas of specialization were identified — business, scientific and systems programming. Consequently, ICCP decided specialized examinations would also be offered in these three areas and candidates would be required to pass both the general portion and their area of specialization in order to be certified.

Examination results show scores tend to increase with education and experience. A substantial portion of the successful candidates have between 5-10 years experience and college degrees.

The date for the 1978 CCP examination has been set for December 9. Interested persons should contact ICCP, 304 E. 45th St. New York, NY 10017, for announcements and study guides.

A catalog freebie

Tandy Computers (the new retail division of Tandy Corporation, parent company of Radio Shack) has available a free 52-page, microcomputer mail-order catalog.

The catalog details popular microcomputers and accessories, software packages, parts and literature currently in stock. Kits and fully assembled microcomputer systems listed in the catalog range in price from several hundred dollars to more than $20,000.

Copies of the catalog are available by telephoning (toll-free) 1-800-433-1679 or by writing to: Tandy Computers, Dept. R7, P.O. Box 2932, Fort Worth, TX

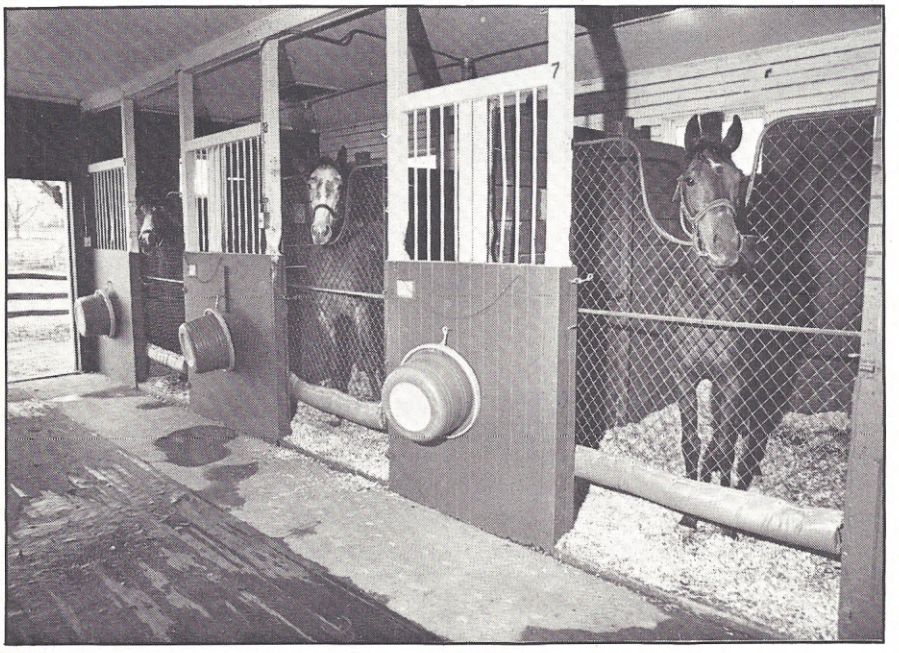
Illustration by Penny Carter

They ain't just horsing around

Effective breeding and buying of race horses requires an encyclopedic knowledge of the animal, sophistication, insight and a healthy application of intuition. With all these highly personal and subjective influences, you might think there's no room for something as impersonal as a computer.

But it was inevitable, and a highly successful application of computer technology to the racing scene has been developed by Moreton Binn.

Binn and his wife Penny created Pen-Mor Thoroughbred Farms where some of the best thoroughbred race horses in the country are bred and trained. In a recent three month period, Binn spent one million dollars for 31 mares and an undisclosed sum for Seat of Power, a prize stallion.



In horse racing, as in royalty, breeding (pedigree) is all important. Aficionados study the lineages of mares and stallions as carefully as a royal commision used to study the blood lines of a claimant to a throne, to determine who the forebears — or in this case, the forehorses — were. How the sire and dam fared during their racing careers and the rest of the family tree are always important.

These questions are not theoretical because the better the track record, the higher the price of the animals and the higher the price for the foals. Binn has found that by going back three generations, enough information about each horse's blood lines can be amassed to make a price decision possible. Before the age of the computer, such information had to be painstakingly accumulated by researching the records of race tracks around the country. Today, all U.S. racing and breeding information since 1928 is stored in a data bank in Lexington, KY.

Every Wednesday, the data bank is updated so a breeder like Pen-Mor has on call every horse in every race, every winner and every dollar of purse money won. A WATS number links the computer to the Pen-Mor terminal 24 hours a day, making up-to-date and complete racing and pedigree information obtainable as quickly as you can say "print out".

According to Binn, Pen-Mor uses the computer for a number of varied purposes. To keep track of all horses sired by Seat of Power, a bi-weekly printout notes their race records. Which of the offsprings are racing and winning, the purses they have earned and any special information is all kept at hand for immediate retrieval.

To purchase mares or fillies, Binn, his managers and trainers obtain printouts of the latest information about a mare or a filly on the day of an auction sale. They determine whether a close relative, sister or brother has recently won a major race, as well as the lifetime performance of the thoroughbred in question. Armed with this information, Binn can establish a price range for bidding on the horse.

At private sales, the computer will tell Binn whether the mare's family and race record are all they are represented to be.

Another interesting application is the buying of thoroughbreds at claiming races. Since many owners and trainers look only at the racing value of a mare or filly and ignore the breeding value, thoroughbreds at racetracks can often be bought for their broodmare value or less.

The Pen-Mor staff reviews entries of most female thoroughbreds running at most tracks along the East Coast, from Boston to Florida. Binn checks with the computer to see whether those horses that appear to have good broodmare value really do.

The best broodmare prospects are then claimed at those tracks where Pen-Mor or Binn races his horses and is eligible to claim. Then, to offset their price and increase their broodmare value, these newly acquired thoroughbreds are spotted in races where they can win purses.

At the other end of the spectrum, when selling mares, an impressive three-generation pedigree often encourages buyers to pay a higher price than they might have planned.

In a more specialized vein, Binn obtains printouts to evaluate a sire by running down the records of all that sire's offspring. This can amount to 400 to 500 horses — certainly not a job to be tackled by hand.

And finally, when a stallion is to be mated, the computer will re-

call whether he had been mated with other mares from the same family and how well the offspring have done. As a bonus, the computer will also recall which stallions have done well with other mares from a particular family line.

With odds like these, how can you lose?

Beware of computerized bears...

Motorists who travel on Interstate 694 in Minneapolis, MN, better learn the rules of the road, and fast. Because if the highway patrol doesn't catch them misbehaving, a computer might!

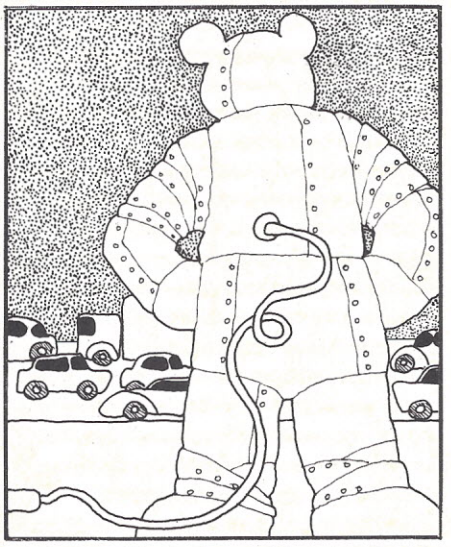
The Minnesota Department of Transportation predicts their minicomputer-based traffic surveillance and ramp metering system on the interstate will be operating sometime this year.

The new traffic management system will use a Honeywell Level 6/43 minicomputer to monitor traffic volume and speed, and control the ramp meter signals and changeable message signs from the downtown traffic management center. It will exchange traffic data with the computer for Interstate 35W and another control system on Highway 169 to coordinate traffic.

A spokesman from the computer manufacturer's Traffic Management Center said implementation of the traffic management project should be able to reduce accidents and congestion on the interstate.

Based on experience with other traffic management projects, the spokesman predicts some additional benefits including a reduction in air pollution, improved gas mileage for motorists and improvement in general driving conditions on the freeway.

Control of the new system will feature use of a microprocessor-based controller that will provide local coordinated control of the entrance ramps in case the link to the downtown computer is temporarily lost. By collecting and processing information from loop detectors installed in the roadbed, the microprocessor will monitor traffic volumes and flow



and pass the information to the computer.

The computer will provide overall supervision of the I-694 system and trade information with the I-35W computer. Two color television monitors will display graphic maps of actual traffic conditions on I-694, providing immediate indication of traffic problems to the state's traffic management personnel.

So if you're traveling through Minneapolis, keep your eyes open for a computer on the prowl.

Apple pickin's and library exchange

A group of Apple II users in Seattle, WA, have gotten together to form A.P.P.L.E. (Apple Puget Sound Program Library Exchange).

The group exchanges ideas and programs through *Call-Apple,* their monthly newsletter. Membership is open to all with a $2 application fee.

If you're interested in joining A.P.P.L.E., send an SASE to A.P. P.L.E. c/o Val J. Golding, 6708 39th Ave. SW, Seattle, WA 98136.

Maximum Security

It is no longer enough to simply restrict or allow access to your building on a daily basis; present management requirements now dictate a number of other factors also be routinely monitored and controlled.

Alarms, environmental changes and invalid entry attempts can all signal a guard, but for a guard to properly respond, he must also have complete instructions for correcting each condition — who to call, the location of the trouble spot and what to do next.

Management, in turn, must be able to monitor the performance of both people and equipment, insuring that each transaction receives the proper attention.

The ability of a computer-based security system to visually display the location of an emergency condition at the time it occurs and specify the appropriate action required is highlighted in a data sheet by Cardkey Systems.

Programmed Access Security System (PASS) operates an entire network of security, access and environmental equipment; displays in detail the corrective action to be taken for everything from unauthorized entry to power failure; and insures such action is taken.

Designed for use in aerospace, electronic, industrial, financial, institutional, nuclear and related applications, this hardware/software combination permits simple system modification to meet user requirements.

PASS provides immediate recall on video screen or printer terminal of both entered and acquired data for a complete audit trail of all operations.

PASS performs personnel access control, environment monitoring and alarm processing functions, and simultaneously carries out a range of other functions — from changing an employee record to performing a search request — using the associated CRT terminal in an interactive mode.

For more information write to: Cardkey Systems, 20339 Nordhoff Street, Chatsworth, CA 91311.

Illustration by Penny Carter

Getting down to business

Computers received a heavy share of the attention at the Second Chicagoland Business Services and Equipment Exposition, which completed a successful three-day run on April 6. Hundreds of exhibitors, including many firms supplying computer equipment and computer services to businesses of all types, brought close to 9000 people to the show.

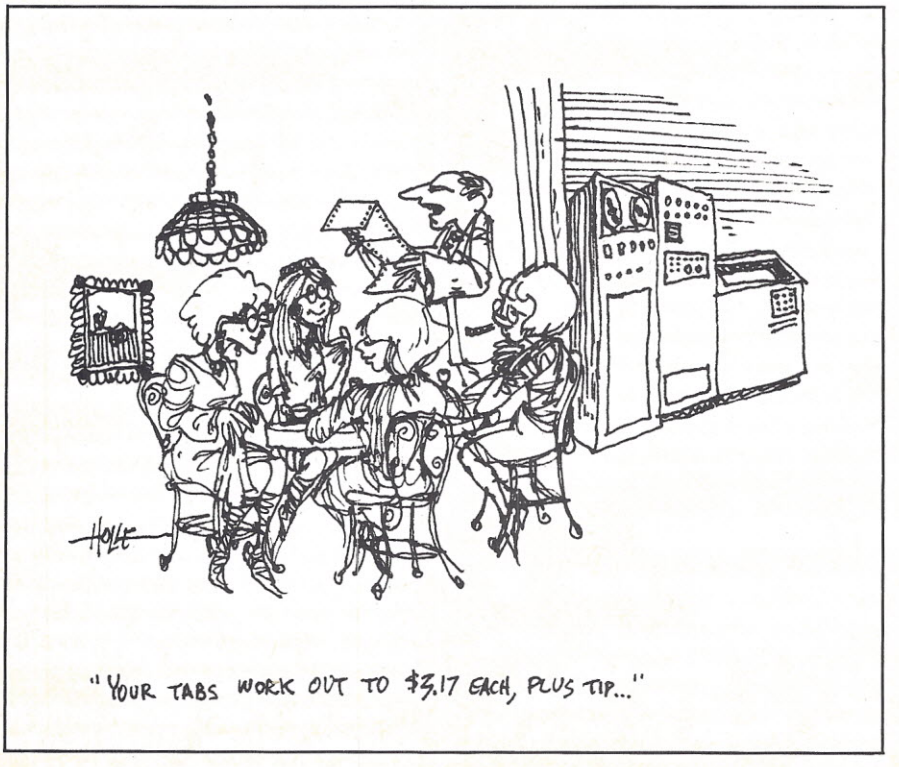
The amount of activity around the mini/microcomputer manufacturers booths was quite noticeable. These computer suppliers noted a strong trend in inquiries concerning the uses of the computer by small and medium size businesses. In addition, many inquiries came from divisions of some large businesses. An intense interest in the small computers was shown by professionals from many areas of endeavor.

John Bannusch from Itty Bitty Machine Company said, "We did a lot of business last year — $60,000 — but this year we did better than that — more names and leads than ever." Other companies at the show included: Radio Shack, Tek Aids, Nabih's, MITS, PolyMorphic, Sperry Univac, Quantum Computer Works, Aspen Computers, IBM, Computerland, NCR, Basic Four, AAA Chicago Computer Center, Wang, Nixdorf Computer Corporation, The Chicago Computer Store, Data General, Lockheed Electronics, Honeywell Information Systems, Control Data Corporation, and Computer Task Group.

The Business Expo was produced by Industrial and Scientific Conference Management, Inc. (ISCM), who will also be organizing *Personal Computing*'s 2nd Annual Midwest Personal Computing Exposition, October 5-8. *PC*'s show will be held in the same facility (the Expocenter) as the Chicagoland Expo, chosen because of the high caliber visitors brought into the show from the close-by, densely populated and business-oriented Chicago Loop.

A conference program of 18 management and profit-oriented seminars, a number of which dwelled on the capabilities and applications of computers in business, supported the Business Expo. The sessions focused on the changing practices which new technology, including computer technology, now make possible.

PC's Midwest Personal Computing Exposition will follow suit with seminars designed to accommodate the small computer needs of businesspeople and professionals who wish to learn more about this mushrooming area of business activity.



The Soft Touch

Pay by phone right from home. Buscom Systems, Inc., announced a Soft Touch Tone Dial which allows customers of banks and thrift institutions to "bank by phone". Consumer bill-paying systems are growing in appeal throughout the United States because of the cost per transaction savings to commercial banks and savings and loan institutions. Consumers like do-it-yourself electronic bill paying because of its simplicity, savings and their ability to earn interest on their demand accounts until funds are electronically transfered to a merchant's account, developers say.

One of the major obstacles in the universal acceptance of direct electronic funds transfer by consumers is the unavailability of push button telephones throughout the country, according to the company. Of the existing 160 million telephones, about 40 to 50 million are of the push button type.

Soft Touch is a tone dial that screws on the mouthpiece of a regular rotary dial telephone and immediately converts it into a push button telephone. The dial has the letters A to Z on the buttons as well as an asterisk (*) and number symbol (#) for commands. Consumers tap in to the bank computer their account number, secret code, merchant code and amount to pay their bills. The consumer saves the cost of checks, envelopes and stamps while earning interest on his money in his savings account until the merchant is paid, the company said.

Soft Touch is both a tone dial and microphone in a standard one cubic inch telephone mouthpiece. The keyboard responds to a light touch.

My Old Kentucky Home Computer

We asked for photos of your home or small business computer set-up back in our March issue. Pictured here we have once such set-up — Steven Roberts' "home" computer system in Jefferstown, KY.

At the time of the photo, Roberts notes, activity focused on the musical aspects of the machine, but rotation of the CRT ninety degrees to the right returns the configuration to normal.

Roberts uses his system, which occupies 60 percent of his living room, for four main functions: hardware/software development for customers of Cybertronics, manuscript and letter text processing, music composition and synthesis, and fun and games — "listed in order of their cost-justification."



As a development system, the Z-2D with Cromemco CSOS and other resident software is hard to beat, Roberts feels. His primary business activity involves the creation of custom microprocessor systems for local industry, often in "somewhat bizarre configurations".

As a text editor, the Diablo printer (hiding behind the table) makes life easy, Roberts says. He noted, again, the flexibility of Cromemco's software, especially the editor, as making the difference between his earlier "hobby" systems and this one.

For music applications, the keyboard scanner and other dedicated hardware take the repetitive functions away from the CPUs, allowing real-time algorithmic functions. Under development is an FFT processor that will allow input via flute, rather than the the keyboard which, claims Roberts, leaves him regrettably befuddled.

In the fun and games category, when time permits, Roberts says he plays chess and other residents of the Cromemco games disk.

Although his living room might not be an interior decorator's fantasy, Roberts says "its evolving contents manage to keep me off the streets."

If you have a photo of your system you'd like to share with our readers, send it to Random Access, Personal Computing, 1050 Commonwealth Ave., Boston,MA 02215

Doctors in the house!

In our February Random Access, we asked for information about "computer doctors" in order to compile a list of emergency numbers you can call to get help fast when your computer comes down with the "bug".

So far, we've received information on two "computer doctor" services.

The first one, Micro Service of Indiana, began in 1976 primarily to perform service on video inspection and surveillance systems. In late '76, they expanded to include microprocessors and related peripheral equipment. Now, 95 percent of their business involves microprocessor servicing.

Some of the equipment recently serviced included Soroc IQ-120, Processor Technology Sol 20 and all S-100 peripherals, Vector Graphic, IMSAI, PerSci disk drives, Shugart disk drives, Poly-Morphic Systems, Alpha Micro-Systems, Cromemco, Okidata, North Star disk and computers, and Dunn instruments and imaging equipment.

MicroService is located at 7724 East 89th St., Indianapolis; phone: (317) 849-6505. And, no, they did not mention whether they made house calls to Wyoming.

In Palo Alto, on the West Coast, you can get your micro serviced at the "Microdoctors". They specialize in repair of S-100 bus products, but also work on various other peripheral devices. Assembly, system configuration, fabrication and consulting are also specialities.

Recently, they hired a full-time programmer and now can provide custom system monitors and special application software.

Jim Prince, one of the shop's three owners, recommends first-time buyers invest in some preventative medicine (before buying) by visiting an organization like the "Microdoctors" to discuss system requirements

Prince believes his group and others who have experience working with various types of hardware are better able to recommend, from a hardware stand-

point, what you need for your specific application. Also, they know which boards will work in specific applications and which ones won't.

One of the toughest challenges the Microdoctors face occurs when a customer comes in with a wide variety of components bought from different sources. Prince commented, "They thought that it would be a matter of plugging the components in and watching the system come-up. How do you tell them there are board incompatibilities? Or how do you tell someone that if he upgrades his system it will not work?"

Seeking advice and considering the long-range application might cost a bit more in the beginning, but when it comes time to move into more sophisticated equipment, it will cost less in the end.

The Microdoctors are located at 2227 El Camino Real, Palo Alto, CA; phone: (415) 324-1460. They also did not say whether they made house calls — either in state or out — but what doctors do anymore?

Up, up and away

The Department of Transportation Federal Aviation Administration awarded Logicon, Inc., a $5.3 million contract to design, develop, manufacture and install a radar training facility for use in training air traffic controllers.

Scheduled for operation in early 1980, the new facility will be installed in the FAA Aeronautical Center in Oklahoma City, OK.

It will provide developmental training and evaluation for both en-route and terminal specialists, using 14 minicomputers, video display terminals, electronic interface equipment and actual radar displays used in air traffic control centers, to simulate conditions a controller might encounter on the job.

By closely duplicating the specialized operational enviornment that exists in the nationwide network of automated en-route and terminal control centers, the facility will synthesize a wide variety of air traffic control situations.

The training facility will accommodate 24 students, each performing a different training exercise. In addition, an individual instructor for each student can participate in the exercises.

As part of the FAA Academy initial qualification training program, the facility will better prepare graduates for work in the field and lessen the need for on-the-job training.

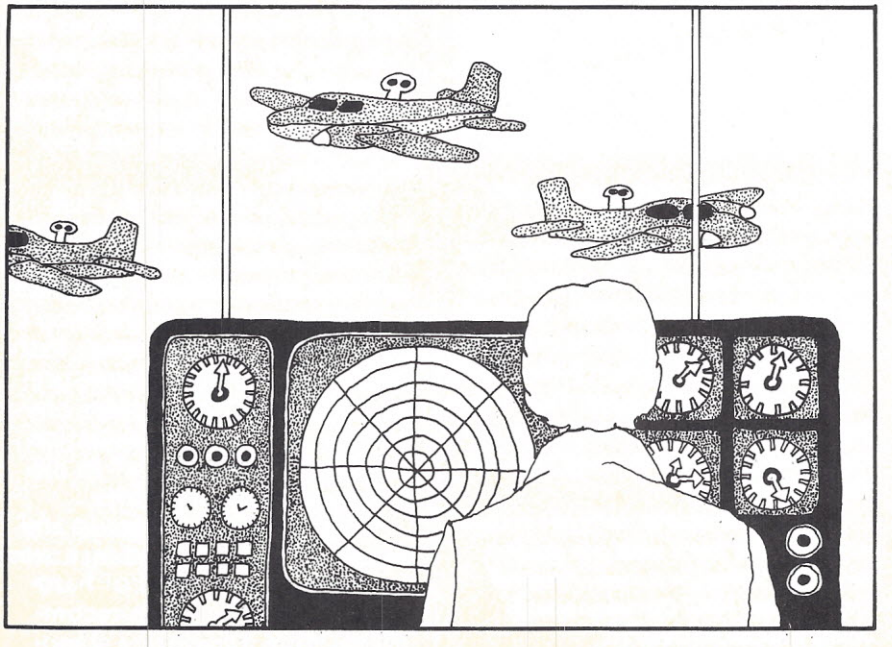


Illustration by Penny Carter

And still another publication

The company that brought you *Microprocessors* and *Computer-aided Design* now has launched a new international, specialist journal, *Computer Communications.*

The journal will cover key technical developments and applications in computer networks and systems design, distributed processing, word processing, telecommunications technology, standards and protocols and the reliability and security of these various techniques.

Aimed at practicing engineers, computer scientists, system analysts and project managers, the journal should interest all organizers who are users or developers of computer and telecommunications technology.

Microprocessors (launched last year) deals with hardware, software and applications of microprocessors and microcomputers. Issues contain technical articles and applications, product and literature reviews, MPU comparison charts, educational features and other regular features.

Computer-aided Design deals with all aspects of computer use in engineering and building design. Regular articles include research papers of CAD work in universities and institutes, news of the latest displays, digitizers, plotters and design software, literature abstracts, conferences and courses and news.

For more information on any of these publications write to: IPC House, 32 High Street, Guildford, Surrey, England GU1 3EW.

Patient update

Pathology departments of six hospitals in Victoria, Australia, have jointly developed a minicomputer-based patient identification system which processes the results of tests and prints cumulative reports on each patient.

Patients' records are stored and updated by entering data

through visual display terminals in the laboratory and patient reception areas.

One hospital reports major increases in efficiency after only about two months of operation. Cumulative reports produced at this hospital provide biochemical and hematological history of patients.

Eventually, with the development of a total laboratory system, microbiological and histopathological data will be included.

In addition to cumulative patient reports for both in-patients and out-patients, the system also produces the latest test results for patients in each ward at any time of the day or night.

Hospital officals say the system has reduced clerical work and the volume of paper records and made quality control easier.

At present, the pathology department uses six visual display units and plans to install two more within 18 months.

The system consists of a Data General NOVA 3 processor with 64K byte memory, a 2M byte disk subsystem, six visual display units, one magnetic tape subsystem and one paper tape reader.

So if you're checking into an Australian hospital, check it out.

Data Directory

If you're in the market to buy, you might find the new *Computer Data Directory* handy.

The first edition of this catalogue for small computer users is available now. Included in the book are manufacturers of systems, peripherals and accessories.

In software, find who handles languages, business applications, household control, games — even custom programming services.

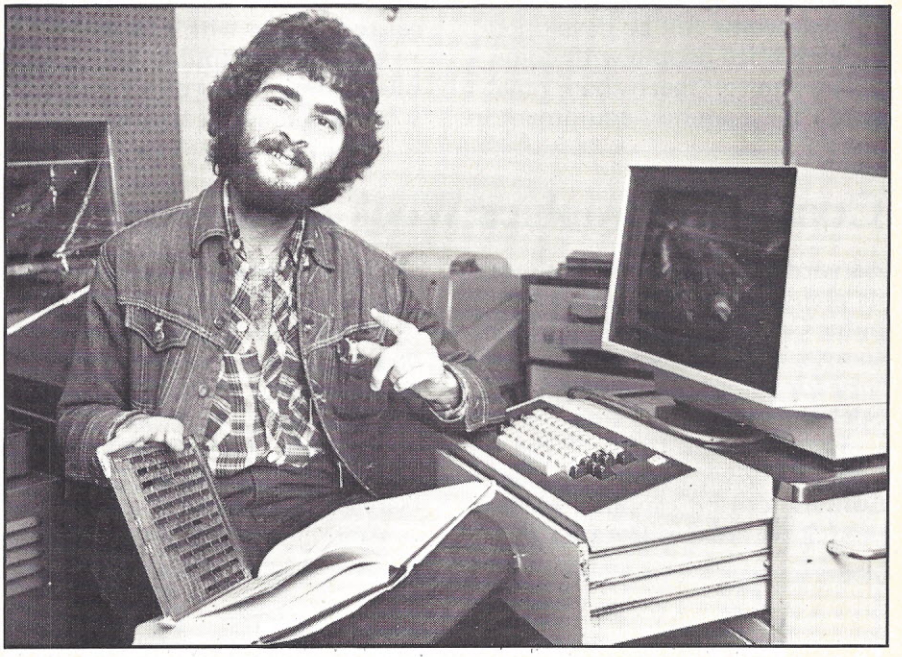
Other items include where to find books, magazines, newsletters, home study courses, data banks, tools and repair services. Computer stores and clubs are indexed geographically.

For your copy send $4.98 (postage included) to: *The Computer Data Directory,* P.O. Box 598, Cleveland, OH 44107.

Humanizing Computers

Do Americans really picture computers as awesome and dehumanizing machines with uncontrollable powers?

A 19-year-old college student believes they do, although he thinks most computers don't deserve this reputation, and he intends to prove it with the help of Signetics, a microprocessor manufacturer.



Robert Weber is designing a laboratory where people will be able to "play" with today's microcomputers to discover how the computer's memory and problem solving power can help them in numerous ways.

Weber began his project as a student at New College of California, an alternative school dedicated to progressive educational change.

Although Weber's concept of a "hands on" computer lab — open to the public as well as to his fellow students — impressed the New College faculty, the budget managers would not supply funding. As a result, Weber approached electronics manufacturers with his concept, and Signetics became the first firm to contribute equipment.

Signetics contributed several types of logic and memory devices as well as the critical component, a high-speed 8 x 300 microprocessor.

Weber said his primary goal in designing the computer lab involves reaching those individuals who still fear the technology. "Most people are suspicious of computers," he said. "Mention 'computer' and their minds click to 1984, Big Brother, the IRS and all those other science fiction horror images."

One of Weber's career objectives is to help change that suspicious attitude. "I believe the computer sciences should actually be thought of as part of the humanities, a view of computers being an extension of mankind's own brain and being," he said. "Perhaps such an attitude will curve us away from the runaway and dehumanizing uses of such technology and guide us toward more constructive endeavors."

Weber has outlined three steps for his project. "The Phase I work that I had begun at New College was mainly initial research. Finding out about such things as internal organization in small colleges, financial considerations, educational concepts and student attitude toward the subject. There I also did some primary design on

viable computer systems, and wrote some letters asking support."

Weber's Phase II work continues at the Mill Valley Program, a small alternative college for gifted students in Mill Valley, CA. There he uses the school's computer to aid him in the in-depth research and design that will culminate in his proposed computer lab.

Phase III, ultimately the most important to Weber, is the one in which classes, workshops and public forums will be developed to familiarize people with computers and to "teach them how to use this common equipment in uncommon ways."

"I'm not just talking about video games and other such fabulous, commercially produced gizmos," said Weber. "I consider systems design an art form, with a potential as an artist's medium as flexible as clay and an educator's tool as universal as the book."

If Weber continues to successfully persuade equipment manufacturers to donate their products, he hopes to bring the project to fruition within 3 years.

Once his computer lab begins operations, Weber also hopes other schools will adopt the concept.

Computer Graphics Week at Harvard

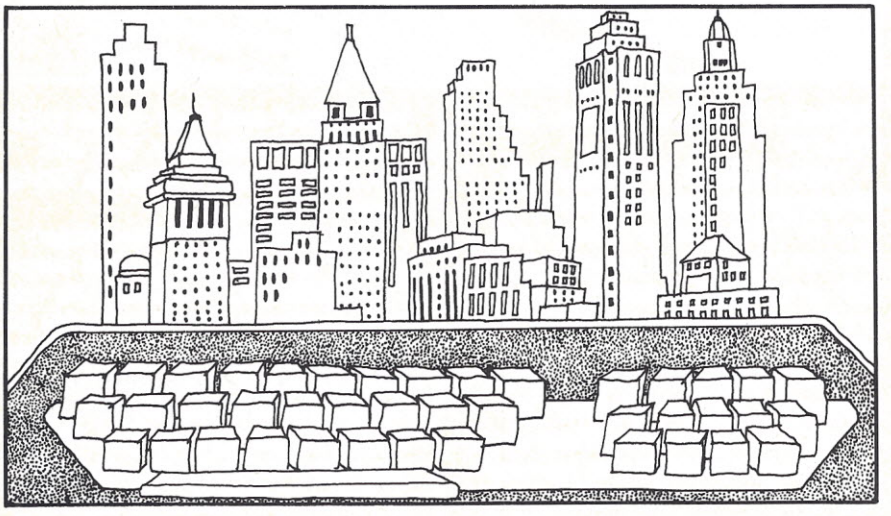
Harvard University has announced its plans for an international Computer Graphics Week July 23-28, sponsored by the school's Laboratory for Computer Graphics and Spatial Analysis.

The event will focus on the Laboratory's International User's Conference on Computer Mapping Software and Data Bases: Application and Dissemination. At the conference, over 100 speakers and numerous exhibits from the commercial, educational and governmental sectors will show how computer mapping is used in city and regional planning, social services, public safety, transportation and engineering, ecology and the environment, energy, public health, marketing, research and development, management information systems and university research and instruction.

In addition, there will be an in-depth review of currently available computer mapping software and data bases, as well as sessions on thematic map design principles and a hands-on workshop at the Harvard laboratory.

Among some of the special features will be a session on software and data base distribution and marketing, and an executive briefing seminar to discuss the relevance and projected impact of computer mapping in the commercial sector.

For more information, contact the Center for Management Research, Ref. PC, Executive Plaza, 850 Boylston Street, Chestnut Hill, MA 02167.



Rural Billing

Approximately 1000 rural electric cooperatives in the U.S. provide electricity primarily to remote areas outside the normal marketing reach of municipal or investor-owned utilities. Because of their cooperative structure, these organizations have special data processing and billing requirements.

To meet these requirements, a software package, the NCR 499 Rural Electric Cooperative Billing System, has been designed by NCR.

In addition to accommodating the special requirements of the cooperatives, the system also simplifies the task of calculating fuel-cost adjustments.

For example, the system automatically calculates each member's capital credits (distributions of surplus funds to the user-members' accounts, roughly equivalent to dividends) at the end of the year.

The system uses ledger cards, with written records on the front side and the same information recorded on a magnetic stripe on the back so information can be processed electronically, for recording complete billing and consumption history.

The ledger cards allow cooperative office employees to respond quickly to members' questions. Quick response takes on added importance since each member is a direct owner of the cooperative.

In many cases, the member-customer reads his own meter and sends in both the reading and the cash payment at the same time. The system simultaneously posts both the reading and the cash receipt.

In addition to electric meters, security lights and up to three other types of charges can be accommodated by the system. It provides notices for customers who have not read their own meters and prints delinquent notices for past-due customers whose balances exceed a certain limit.

For more information, write: NCR Corporation, Ref. PC, Dayton, OH 45479.

Illustration by Penny Carter



CRT/TERMINAL

Fully Assembled And Tested ! ! !

$399.00

STANDARD FEATURES:

16 x 32 SWITCHABLE TO 64 x 16 DISPLAY
RS232 I/O PORT
GUARANTEED FOR 90 DAYS

OPTIONS:

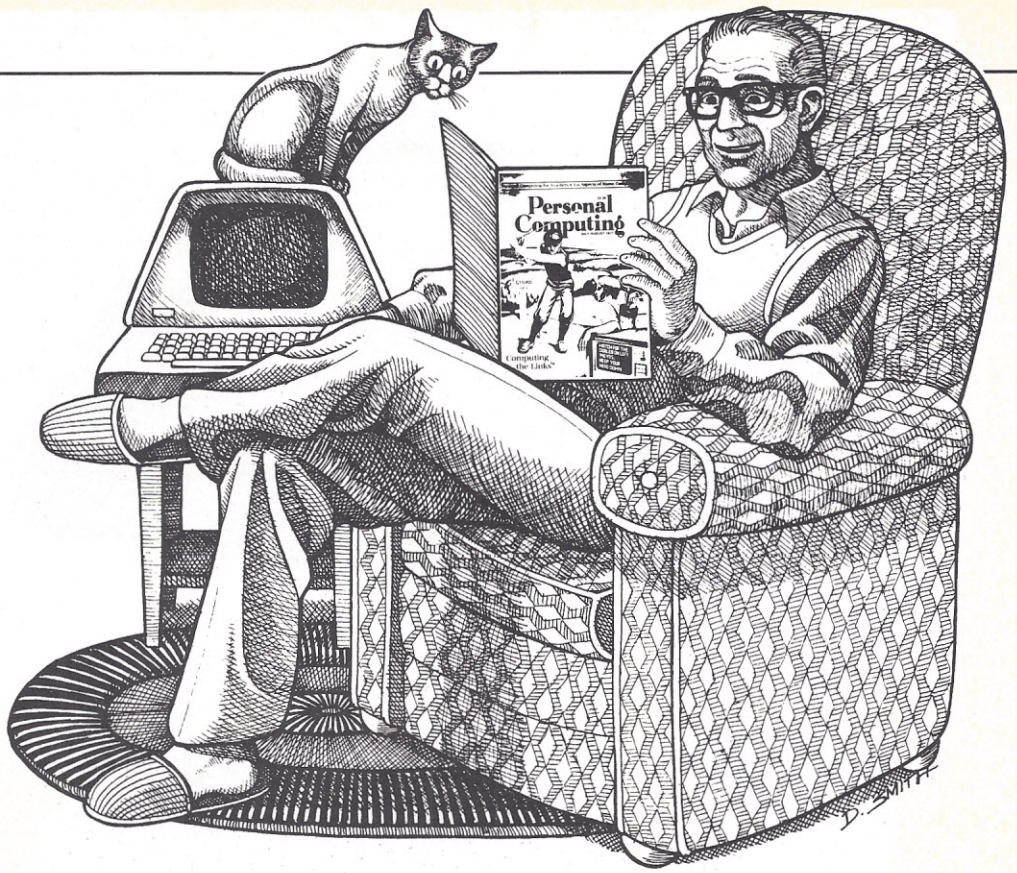
- **9'' OR 15'' MONITOR**
- **NUMERIC KEY PAD**
- **SPECIAL FUNCTION KEY PAD**
- **MODEM**
- **S100 BUS BACKPLANE**
- **PLUS MANY MORE - CIRCLE BINGO NUMBER FOR MORE DETAILS**

Caldwell Computer Co.

546 West Olney Avenue
Philadelphia, PA 19120
(215) 224-9133

Sam Caldwell

CIRCLE 10



Leading the way to computer mastery . . .

Maybe you own a computer. Maybe you're thinking about buying one. Or perhaps you're just curious about the computer world. Let *Personal Computing* show you how to use microcomputers for fun and profit.

A year's subscription brings you 12 monthly issues filled with informative, easy-to-read articles on all aspects of personal computing. Games to play, money-making ideas and applications and programs for home, business and educational use are just a few of the topics covered in *Personal Computing.*

We provide instructive articles on computer basics as well as more advanced articles.

So learn to master your computer the easy way; curl up in your favorite chair with *Personal Computing.* Use the attached coupon to order your subscription today.

Personal Computing Magazine

I've been bitten by the bug. Enter my subscription to Personal Computing today!

NAME_____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

USA

☐ 1 year (12 issues) $14
☐ 2 years (24 issues) $26
☐ 3 years (36 issues) $38

☐ Bill me
☐ Check enclosed
(you'll receive one extra issue for each year!)

Charge my:
☐ Master Charge
☐ Bank Americard

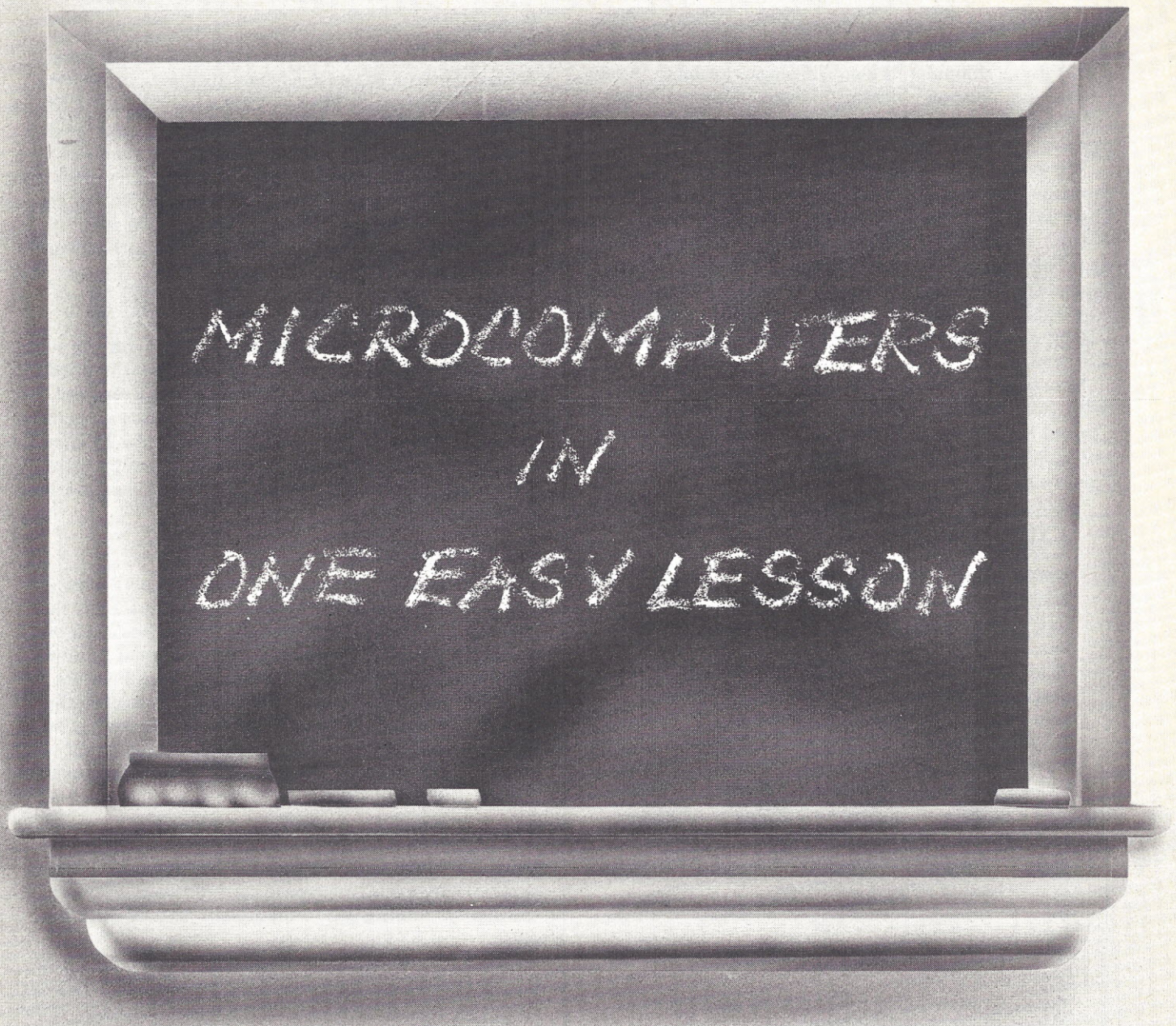
Account # _____
Card expiration date _____

ADDITIONAL POSTAGE (per year)

CANADA & MEXICO $4.00 surface $8.00 air
OTHER FOREIGN $8.00 surface $36.00 air
(Please remit in US funds – Thank you)

BACK ISSUES $3.00/COPY
(Payment must accompany order.)

Mail to: PERSONAL COMPUTING, 1050 Commonwealth Ave., Boston, MA 02215



When you're just entering the microcomputer field all the options you need to consider and decisions you have to make before buying a system can be overwhelming. This primer discusses some of these factors.

Illustration by David Gardner

A microcomputer (as small computers are sometimes called) is based on a microprocessor. This Central Processing Unit (CPU) gives a computer its incredible logic capability. A microprocessor operates according to instructions contained in a program and with data contained in the computer's memory.

The word size (or data width) is the number of bits of information the computer processes with each instruction. There are many types of processors with data widths of 1, 4, 8, 12, 16 and 32 bits. Most small computers use 8 bits. Some more expensive computers use 16 bits. They are perhaps a little faster, but not enough to make a difference in most applications. Generally, an 8-bit processor can do what a 16-bit can, but the program will probably require more instructions.

Most popular processors are 8-bit types – the 8080, 6800, Z-80, and the 6502. The 8080 is by far the most popular and has become standard in many cases. The Z-80 is like an 8080 with added instructions. It also operates faster than the 8080.

Glossary

ASCII – American Standard Code for Information Interchange. The ASCII code is the standard binary representation for numbers, letters and control characters.

Assembler – A program that translates assembly language programs, written by humans, into machine codes which the computer understands.

BASIC – Beginners All-purpose Symbolic Instruction Code. BASIC is one of the easiest-to-learn computer languages. It is used in most small computers. BASIC runs efficiently in most computers and requires less memory than many other languages.

Binary – Number system based on 2. All binary numbers consists of only 1s and 0s.

Bit – One binary digit. The smallest unit of information. A 1 or 0.

Byte – 8 bits. Most small computers process information 1 byte at a time.

Bus – A communication line used by many parts of the computer. S-100 and SS-50 are two common standards for computer bus structures.

Clock – The computer's timing circuit or "heartbeat"

Compiler – Translates a high level language such as BASIC (written by humans) into machine code which the computer can understand.

CPU – Central Processing Unit. The "brains" of the computer. Also called MPU (Micro Processing Unit).

CRT – Cathode Ray Tube. A video display tube like a TV screen.

Debug – To remove errors from a computer or its programs.

DMA – Direct Memory Access. Transfer of data between memory and peripherals without using the CPU.

Firmware – Software programs that are built into the computer and contained in ROM or PROM.

Floppy Disk – A flexible magnetic diskette used to store large files of information, approximately 70K or 250K depending on which of the two sizes you get. Information can be transferred at a very fast rate.

Memory

Memory can be of several types. There is RAM (Random Access Memory), ROM (Read Only Memory), PROM (Programmable Read Only Memory) and a few others. Data is written into and read out of memory by addressing specific memory locations. The amount of memory a computer can work with is determined by the number of address lines controlled by the processor. Most processors have 16 address lines which can address 2^{16} or 65,536 words of memory. In some cases the amount of memory is limited by hardware or the power supply.

Input/Output devices

A computer is not worth anything unless you can talk to it. Getting information into and out of a computer is called I/O (input/output) and is usually done with a keyboard and either a TV monitor or a printer. CRT terminals are perhaps the handiest as they have both a keyboard and a TV monitor as well as the necessary electronics to interface to a serial port. Sometimes the I/O device is built into the same cabinet as the computer.

Input/Output ports

Interface circuits – either a serial or parallel port – are required for communication between the processor and the outside world. In a parallel port, the data moves along parallel lines so that all 8 bits in each word are sent at the same time. In a serial port, the bits of data all move down the same line, one after the other. Parallel ports are normally used for printers and keyboard inputs. Serial ports are normally used for CRT terminals. Two common electrical standards for serial ports are the RS-232 (voltage level) standard and the 20 ma current loop.

Bus structures

Most small computers (the ones that are expandable and flexible) have a bus structure to carry the data, address, control and I/O information to the various parts of the computer.

The most popular bus configuration is called the S-100 bus. Most 8080 and Z-80 computers use this bus. S-100 bus computers (Processor Technology, Cromemco, Altair, IMSAI and so on) allow you to add memory, interface ports, battery back-up boards, music system boards and so forth simply by plugging in the circuit boards. Many manufacturers support the S-100 bus.

The second most popular bus is the SS-50 bus used by 6800 processors. It has 50 pins rather than 100 because of the way data and I/O are handled.

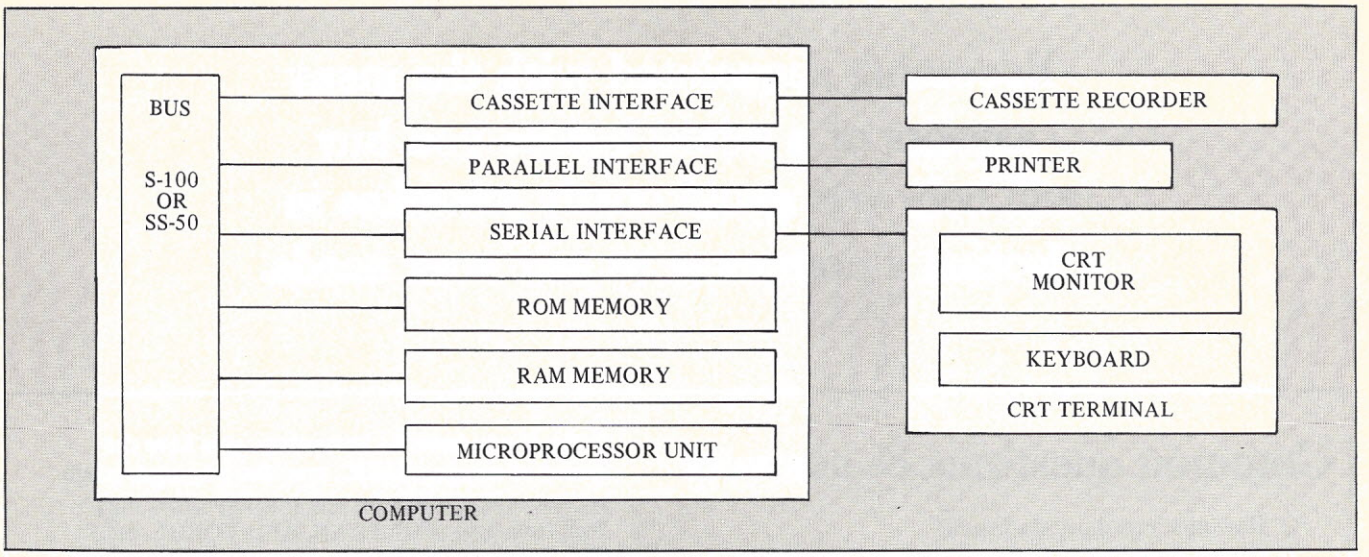
Storage methods

Programs and data can be saved for future use by several methods. The most popular method is using regular audio cassette tapes, which require a cassette interface to convert digital data to audio tones and vice versa. This low-cost technique is popular with home computers. The most popular standard for storing information on tape is called the Kansas City Standard.

Paper tape is another way to store data, but not quite as convenient or popular as cassettes. Data is stored on the paper tape via punched holes.

The fastest but most expensive means of data storage is the flexible magnetic diskette or "floppy disk". These disks

A Look at a Typical System



A typical system (with SS-50 or S-100 bus) is shown here in block diagram form. This flexible, expandable system can be upgraded. It will accept more memory, more peripherals, or whatever the application might demand.

come in two sizes, 5-¼-inch or 8-inch diameter, and look like 45 RPM records. The surface is a magnetic substance similar to that found on magnetic recording tape. Special disk drives and interfaces are required to operate a disk system.

Floppy disks are used primarily in businesses where the extra speed is worth the extra cost. A program requiring over 10 minutes to load from cassette tape can be loaded in a fraction of a second with a disk system.

System monitor

Many computers have a system monitor in ROM which contains the program necessary to operate the system. This allows you to examine the data in memory, enter data, run programs and save or load data from tape.

Software

A computer is useless without programs to make it run. Software comes in a variety of forms. It can be a machine language program that runs in the computer "as is", or it can be in a high level language program that must be compiled or interpreted to machine language that the computer can understand.

Most small computers have a BASIC interpreter. BASIC is a very simple, easy-to-learn language that lends itself to many applications. It can be used for personal computing, business, industry, education and science.

Other high level languages are also available. Some hobbyists enjoy programming in assembly language, then using an assembler program to get the machine code.

You can buy software on cassette, disk or paper tape. You can get program listings from books or magazines, enter them into the computer via the keyboard, then save the programs on cassette tape. You can also write your own programs and save them for future use.

Home Systems

The computer in the home can be useful as well as entertaining. It can be more enjoyable than watching TV because it is an interactive process which is also educational. Useful functions for the home computer include checkbook maintenance, household budget, recipe file, diet and menu planning, shopping lists, record keeping and education for all members of the family. Many experts predict that home computers will become popular at an increasing rate until they are commonplace by 1985.

Here are two typical home systems:

Typical Home System 1

	kit	assembled
Sol-20/16 (16K RAM, BASIC-5)	$1850.00	$2095.00
9" monitor	175.00	175.00
Total System Price (less recorder)	$2025.00	$2260.00

Typical Home System 2

SWTP MP-68 computer (w/4K)	$ 395.00	$ 495.00
4K RAM additional	100.00	150.00
CT-64 w/CT-VM monitor	500.00	700.00
AC-30 cassette interface	79.95	120.00
4K BASIC	4.95	4.95
Total System Price (less recorder)	$1079.90	$1469.95

Hobby Systems

The computer hobbyist is often interested in using the computer with another hobby, such as ham radio, model railroading, chess, music, computer art, astronomy, robotics, or speech recognition and synthesis. Many hobbyists have some electronics experience and are willing to build their own computer from kit form. This typical system uses a TV set for the video display and a cassette recorder for program storage:

Typical Hobby System

SWTP MP-68 computer kit (with 4K RAM)	$395.00
Percom CIS-30+ cassette interface kit	79.95
CT-64 Terminal kit (less monitor)	325.00
Pixieverter kit (for TV set)	9.25
Total Price (less TV and recorder)	$809.20

Education, Science and Industry Systems

Small computers have made a tremendous impact on education, both at home and in the school. The computer can be used to help students in almost any subject. Computer Aided Instruction (CAI) can teach a student on a one-on-one basis according to a programmed lesson, enabling the student to progress at his best rate.

Becoming acquainted with the many aspects of a micro before you buy will help you avoid costly mistakes in selecting a computer to suit your needs.

Common questions & answers

Q. How much memory do I need?

A. To run programs in machine language, you might get by with 4K or 8K of RAM. For BASIC you need memory for the BASIC interpreter, then more memory for the program. To run small programs with the Southwest Tech 4K BASIC, for example, you need 4K of RAM for the BASIC and perhaps 4K more for programs. That's 8K total. Using the Southwest Tech complete 8K BASIC with longer programs, at least 16K would be required. For home and hobby use, most people start with about 8K of RAM. For other applications such as business, 32K will support most needs. Keep in mind that you need the capability to add more memory with S-100 or SS-50 memory circuit boards. These circuit boards are available from many different manufacturers.

Q. What do I need to know about computer bus structure?

A. The S-100 bus is the standard bus configuration for 8080 and Z-80 computers. Computers with the 6800 microprocessor normally use the SS-50 bus structure. If you buy a computer that uses one of these standards, you can be assured of having a system that is flexible, expandable, easily serviced and compatible with most other small computers on the market.

Q. What are the main differences between different brands of terminals?

A. The main differences are quality of display, number of characters presented on the screen, number and type of keys on the keyboard, quality of the keyboard, and the speed of data transfer with the display. Don't buy a unit with a keyboard before you try out the keyboard. It should feel comfortable and should operate smoothly. The speed of data transfer is called the baud rate. The terminal should have adjustable baud rates up to at least 1200 baud. Some keyboards have a numeric keypad at the side which is handy for business use.

Q. Don't some computers have BASIC in ROM?

A. Yes. If BASIC is in ROM memory, you don't need to load BASIC every time you turn on the computer. But keep in mind that you lose lots of flexibility, because you cannot change the program in ROM. If you have RAM memory, you have the choice of running BASIC, machine language, music systems, chess programs and possibly other high level languages (FORTRAN, APL, COBOL, etc.).

Q. How can I add things like printers, other terminals, etc.?

A. It is not difficult to add printers or other peripherals if you have the proper serial or parallel interface on your computer. For example, if you want to add a printer, you need a parallel port. If you don't have a parallel port handy, you can get one that plugs into the S-100 or SS-50 bus.

Q. How do I store programs and data for future use?

A. You can use cassette tapes, paper tape or "floppy disks". If your system has a cassette interface, find out what kind it is. The Kansas City Standard type (one of the most popular) is quite reliable. Some computers use two types of interfaces, the Kansas City Standard and their own (which is usually faster). If you're thinking about getting a disk system, be sure the price includes the disk drives, cabinet, power supply, floppy disk operating system (FDOS), disk extended BASIC, interface circuitry and the disk controller – all needed for a disk system to operate.

Q. Are all BASICs the same?

A. Not exactly. There are some slight differences between the BASIC languages offered by the different manufacturers, but these are usually very small differences. Some computers offer a full BASIC and a smaller BASIC to save on memory. For example, Southwest Tech has both 8K and 4K BASIC. The 4K version does not have string variables or trig functions. They also have a disk BASIC, which is the 8K BASIC plus disk commands. Processor Technology has disk BASIC, 8K BASIC and BASIC-5. Some manufacturers claim to have BASIC, often in less than 4K, which is really a micro-BASIC. These "tiny" BASICs are better than trying to program in machine language, but they fall short of the tremendous capabilities of a full 8K BASIC.

Q. Why do some brands of computers have lots of switches and blinking lights on the front panel?

A. These lights certainly add to the cost of a computer, but the final effect is that the unit simply looks more like what a computer "ought" to look like. I give up, why do they?

Computer science departments are becoming decentralized by the small computer, adding efficiency and reliability to department operations. In the past, when the big central computer went "down", the entire computer department was "down". With several independent small computers, malfunctions are less common. When they do occur, only the system at fault is down. The other students can still do their work. The convenience of interacting with a small computer means time saved.

The small computer provides ready computing power in the lab. The scientist or engineer can use the mathematical and analytical capabilities of computers to aid in research and design. Having a computer handy saves time. Without one, the scientist usually has to perform calculations with a pocket calculator or get involved with interdepartmental procedures to use the big computer.

Small dedicated computers in industry provide fast and accurate control of production line operations. Gauges, heat sensors, motors, relays and heaters can be read or controlled by computer to increase efficiency and reduce waste. The small computer can also be used for fire and smoke detection, perimeter systems control, maintenance control and alert, and environmental/energy control.

Business Systems

Business is perhaps the most obvious application for small computers. Many businesses can now afford computers. Only a few years ago a business computer cost $100,000 or more. Now, the system hardware usually costs less than $10,000.

A home computer by itself is normally not suitable for business use. A business system needs to be very reliable. It needs to have a floppy disk memory system and usually a printer. Floppy disk systems usually come with two drives, allowing more storage capacity and the ability to copy from one disk onto another disk.

Small businesses with limited uses for the computer can often meet their needs with the small disk or "microfloppy". These disks are 5¼ inches in diameter and can store 80K or more per disk. For full business functions, you need a full size floppy disk system. These disks are 8 inches in diameter and can store 250K or more per disk.

Printers come in a variety of sizes and speeds. For light use such as occasional printing of reports, the Centronics Micro-1 ($595) is a good buy. For medium use, such as printing mailing labels, payroll checks, and weekly or daily reports, the Centronics 700 is good. Heavier use, which demands constant use of the printer, means speed is the most important factor to consider.

Business applications include payroll, cost accounting, inventory control, accounts receivable and payable, general ledger, word processing, sales analysis, mailing list maintenance and market survey tabulation. If that's not enough work to justify using a computer, you can also program it to do work scheduling, bid estimates, financial planning and analysis, real estate and loan evaluation, tax calculation, appointment calendars, stock market analysis, personnel records and trend analysis.

Software is the key to a successful business system. Most businesses underestimate the role that software plays. There are several ways to get software for a business. You can get an independent systems analyst to look at your needs and produce the software. You can sometimes get ready-made programs to do what you want. However, most businesses require their own unique software because they want their own kind of reports. It is usually better to get the computer hardware and software to fit the business rather than try to change the business to fit the computer.

Service is an important factor in considering a business system. The system must be easily maintainable and have factory authorized service available.

The following systems are typical business systems with varying capabilities. Other systems are also available. These systems are all assembled and tested. They all include dual drive floppy disks with power supply, cabinet, floppy disk operating system (FDOS), disk BASIC, system controller, and interface.

Mini Business System

Computer, Southwest Tech 6800 (MP-68)	$ 495.00
Memory, 32K (M-16-A)	758.00
System ROM, SWTBUG	19.95
Terminal, CT-64, CT-VM	700.00
Floppy Disk System, MF-68	1200.00
Printer, Centronics Micro-1	595.00
Parallel interface, MP-L	65.00
Printer cable and connectors	35.00
	$3867.95

Good Business System

Computer, Sol-20/32 (with 32K RAM)	$2395.00
CRT monitor, 9"	175.00
Floppy disk, iCOM FD2411-46 (5¼-in drive) with FDOS and Disk Extended BASIC	1505.00
Printer, Centronics 700 (60 cps)	1520.00
Printer option, 2 channel vertical format unit	125.00
Printer option, rear tractor paper feed.	100.00
All required cables and connectors	45.00
	$5865.00

Better Business System

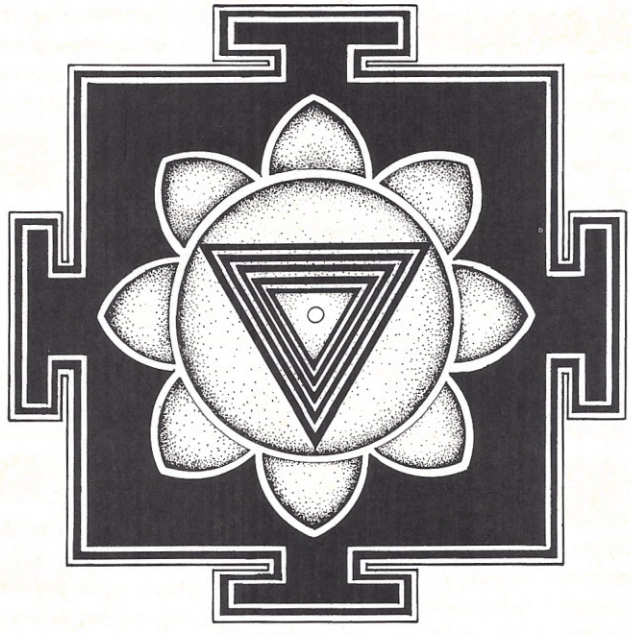
Computer, Sol-20/32 (with 32K RAM)	$2395.00
CRT monitor, 9"	175.00
Floppy disk, iCOM FD3712-60 (8 inch) with FDOS and Disk Extended BASIC	2650.00
Printer, Centronics 700 (60 cps)	1520.00
Printer option, 2 channel, vertical format unit	125.00
Printer option, rear tractor paper feed	100.00
All required cables and connectors	45.00
	$7010.00

Best Business System

Computer System: Processor Technology Sol System III, with Sol-20 computer, 50,176 bytes of memory, BOOTLOAD personality module, Helios II Model 2 disk system (769,000 bytes), Extended Disk BASIC, PT-872 video monitor, PTDOS, and documentation	$5995.00
Printer, Centronics 703 (180 cps) with rear tractor paper feed	2805.00
Printer option, 2 channel vertical format unit	125.00
All required cables and connectors	45.00
	$8970.00

Reprinted with permission. Computer Port Catalog No. 2, *Computer Port, 926 N. Collins, Arlington, TX 76011. Copyright © 1977 by General Cybernetics Corporation.*

Programming



the most complex computer

So you think you are an expert programmer! You can set up and play all the games on mini, maxi and micro computers, make Christmas cards and funny faces, and land rockets on the moons of Mars.

If you're that good, there's one special computer you might like to try your hand at programming for fun and profit. It's the most complex computer currently manufactured, with a memory base of thousands of bytes, a mainframe storage unit, central processor, three or four subsystems, several simultaneous input channels and multiplex output capacity. This computer is also the fanciest and most sophisticated available. Its capabilities are so fantastic not even the "reproducers" know them all.

Compared to the 8080 or the 88, they are hardly expensive. New ones, available for a few hundred dollars, come in two types, M or F. Used ones are also readily available, though maintenance can be high. Delivery time on new units is 10 lunar months. Power supply is chemical rather than electrical.

The computer I'm writing about is the human mind.

Whether you know it or not, you are in fact programming your mind every day. The real question is whether you program it well or poorly.

Programming the mind is the subject of BioMeditation, an integration of hypnosis, biofeedback and meditation, developed by Dr. Buryl Payne, director of the Institute for PsychoEnergetics in Brookline, Massachusetts, and Carmen Reitano, a hypnotherapist working in the computer science field. The programming system comes in the form of a comprehensive manual of experiments, techniques and games; a training tape for basic programming; and a GSR (galvanic skin response) biofeedback instrument.

Programming the mind can be challenging as well as worthwhile. Whatever you've learned about programming computers will most likely help you in programming your own computer-mind.

All of us program our own minds, only we generally don't realize it. Delayed feedback, the complexity of the outputs, the mixing of programs, or sloppy programming all result in so much confusion that most of us don't rec-

Illustration by Barbara Leonard

ognize the patterns and general principals that govern our lives.

The old computer adage "garbage in – garbage out" applies to the human computer just as much as to any other computer system. When people don't know the principles of programming, don't know the mechanisms and general operating principles of the system and don't have clearly defined program objectives, nothing much can happen.

The result is usually a warm "fuzzy", lives a tangle of chaos and confusion, bodies that don't work properly, a general degradation of performance arising from contradictory programs or actual self-destruct programs.

Authors Payne and Reitano base some of their postulates about the human computer on modern psychology and Eastern techniques of meditation.

They assume the system consists of one rather amorphous blob with two primary input channels and three secondary ones. There are two differently working mainframe components called left and right hemispheres and several independent, but interacting subsystems, identified as the physical, emotional and sexual centers. These subsystems, sometimes called the "subconscious mind", interact strongly with all programs introduced to the main system and must be either taken into account or programmed around for lasting effectiveness.

In addition to the main system and subsystems, the authors postulate there is a supersystem which can be accessed with the proper program. Many geniuses have, apparently, accessed their own super computer, and so can anyone else – with the right key.

The first basic programming principle to remember when working with the human mind is: DECREASE THE NOISE.

Most minds are full of chitchat – a random collection of old programs which circulate continuously in the central processor (called the "conscious mind") modulated by subsystem activity and continuous real-time input.

To be successful, any new inputs must be "heard" above this noise background.

Here is where the biofeedback instrument comes into use.

The unit in the BioMeditation system is one of the latest designs (Payne developed the first general-use biofeedback instruments in the late 60 s) to use one IC.

To operate the unit, you simply rest two fingers on the metal sensor plates. Skin resistance, indicative of sympathetic nervous system activity, is thereby monitored. Thus, the instrument enables the "noise" of the emotional subsystem to be fed back in the form of a tone of varying pitch. As the sympathetic activity decreases, the pitch of the biofeedback instrument drops. Through experience, the user learns how to drop his internal noise level.

Often considered more effective and objective than traditional hypnosis or meditation, GSR biofeedback is an important application of technology to human behavior modification.

A training tape included with the Biomeditation system also helps teach you how to reduce your internal noise.

While it is usually not feasible to cool the human computer in liquid helium, it is possible to reduce external noise by retreating to or, if necessary, creating a quiet, dark place for the programming process. Executives and kids have been known to hide in closets, under the covers, or inside pyramids.

When the mind is quiet, it is ready for programming. For best results, programs should be SIMPLE, POSITIVE and CLEAR.

Both visual and auditory inputs may increase the effectiveness of the program. The language used – English – is refreshingly redundant, though often ambiguous. Here is where programming experience helps; it's easy to program in a command which is not really what you want, though it may be precisely what you programmed.

The human computer works on the basis that the loudest program wins. Whatever you program in must compete with all past programs as well as all future programs. This differs from the logic most programmers are used to. Humans are not thought of as logical beings. But they are; their logic is just affected by the weightings of emotional, physical or sexual subsystems, if not powerful contradictions. It all depends . . .

Such ever changing, ever challenging activity makes for hours of fun for the novice or the expert.

Another principle for human computer programming is: CONFLICTING PROGRAMS SHOULD BE CANCELLED.

If conflicting programs are not cancelled you will either get no results, alternating behavioral outputs or nonsense. This fundamental principle, so obvious to experienced computer programmers, often escapes so-called professional human programmers, called "teachers". In extreme cases, conflicting programs could destroy the computer (drive it nuts).

It can be difficult to recall programs for cancellation that have been programmed in early childhood, at birth, or even before. Such early programs may be in a language other than English; perhaps visual, tactile, or experienced primarily in the physical subsystem with little connection to the main processor.

The designers of the BioMeditation system have developed some general ways of clearing the mind which not only use the main processor, but make use of the dream mind and the supercomputer. In addition, they devote some time to programs which may enhance the capability of the system to open up input channels not ordinarily used (called extrasensory perception), to programs which improve the working of the system itself, and to just about whatever one wishes.

All in all, it is a fascinating game to systematically program the most complex computer in the world. One's whole life is the output! Each output event is also input for the next sequence. The universe is the limit! □

The BioMeditation System is available from: The Institute for PsychoEnergetics, 126 Harvard St., Brookline, MA 02146. ($39.95)

CONTRACT FULFILLMENT

BY SAM NEWHOUSE

Many companies sell their goods and services using performance contracts, in which the number of units the customer promises to buy determines the rate he pays. For example, the customer who buys 1000 units per year pays a lower rate than the customer buys 100.

Newspapers use performance contracts when selling advertising space. Keeping track of which customers are buying the space they promised to buy and how much space a given customer needs to buy to meet his contract for the year is extremely difficult with conventional records. Using a computer to monitor contract performance makes locating such information as easy as typing "RUN".

This program, called "ADS", was designed to keep track of 2000 newspaper advertising linage contracts, but you can modify it to suit your own business needs.

Information generated by this program provides a valuable sales tool to advertising departments. In rare cases, a short-rate might be charged to a customer who did not fulfill his contract. In most cases, however, the account salesman will go to the customer three months before expiration and inform him how many lines he must use to avoid a short-rate. On most newspapers, this information is unavailable except for the very largest accounts. Short rates are rarely, if ever, collected, and newspapers can't tell customers how many lines they've used for the contract year to date.

Existing Accounting Procedure

Consider how a typical newspaper keeps track of its advertising accounts. Each day, the advertising department generates a pile of insertion orders – one order for each ad in the day's paper. Salesmen fill out these insertion orders, which specify running dates, rate, depth and width in columns, and give them to an advertising clerk. (Each ad, or transaction, is measured in lines and columns. Lines times columns equals number of lines in the ad.)

The clerk then multiplies depth times width times insertions and writes the total on the order.

The pile of slips then goes to the accounting department where each transaction is posted on a bookkeeping machine ledger card. At the end of every month, the accounting department mails statements, produced from the ledger cards, to each account. These statements only list total dollars for the month; lines used for each month are unavailable except by manually adding up the lines on the ledger cards.

Performance Contracts

Companies using performance contracts give their customers rate cards showing the rate per unit for each level of use (see Table 1).

Table 1 – U. S. Widget Rate Card 1 Year Contract

Number of Widgets Bought	Price Per Widget
1	$10.00
10	9.50
100	8.75
500	8.25
700	8.00
1000 +	7.50

Most customers fulfill their contracts, buying the number of units they promised to buy at the beginning of the contract.

However, sometimes a customer buys more than his contract specified, entitling him to a rebate. For example, look at our widget rate card (Table 1). Say Company Y signs a contract to buy 500 widgets. Its price per unit is $8.25. Now, let's assume Company Y actually purchased 720 units during the contract period.

The rate per unit for 720 units is only $8.00. Company Y paid 720 X $8.25 = $5,940. Since it was entitled to the $8.00 rate, it should have paid 720 X $8.00 = $5,760. Thus, Company Y deserves a rebate payment of $5,940 - $5,760 = $180.

Companies charge customers short-rates when they buy fewer units than they promised to buy. For example, Company Z signs a contract to buy 500 widgets during the year. However, it actually buys only 230 widgets. Company Z actually paid 230 X $8.25 = $1,897.50. They should have paid at the 100 widget rate – 230 X $8.75 = $2,012.50. Thus Company Z owes a short-rate of $2,012.50 - $1,897.50 = $115.

To pay out rebates or collect short-rates, companies must keep track, in the past manually or now with a program like ADS, of the contract performance of their accounts.

Accounting with a computer

Now consider how a microcomputer improves the procedure. Salesmen write an account number on each insertion order. The advertising clerk still performs his existing job.

The accounting department clerk then inputs to the computer daily transactions from the insertion orders. Using 30-character-per-second terminal with phone coupler, the clerk calls the computer, enters today's date, enters the transactions one at a time, edits the transactions (if necessary) and finally updates the accounts file.

For each account, the system stores name and address, contract expiration date, contract lines, rate per line, whether the contract is self-renewing and the number of lines the customer has used for each of the 12 months in the contract period. (Contracts expire throughout the year.)

Operating the System

First, the clerk enters today's date, which is stored in a disk file. The system automatically checks to see if any accounts have reached their contract expiration date. If so, details on that account are printed, and the clerk decides whether to zero the monthly totals. If the account is zeroed, the computer stores the account's old status, including all monthly sub-totals, in a permanent kill file for later reference and audit trail study.

Next, the accounting clerk enters details of transactions (ads) into a temporary file with the account number for each ad entered first. The system displays the account name to ensure that the account number was correct.

For each transaction, the clerk enters depth, columns and number of insertions, which are multiplied to give total number of lines. The transaction file stores all of the above information.

When all ads have been entered, a list of the day's ads is printed out. The clerk checks the list against the actual documents and corrects any errors.

When all of the day's transactions have been entered and verified, the computer updates the appropriate account files and deletes the temporary transaction file.

At any time, a detailed listing of any or all accounts' status may be printed. Typically, the advertising director will want a list of all accounts which expire in the present month or within the next three months. The clerk may specify any number of months to go until the contract expires. If "zero" is entered, all accounts are listed, regardless of when they expire.

For each account, the listing shows name, contract lines, expiration date, current date, account number, rate per line, lines used since start of contract and whether contract is self-renewing.

New accounts may be added to the account file at any time. The system first requests an account number, then it checks that the new number is not in use. If it's already in use, the computer displays the name of the account using the number and requests a different account number.

After entering name, address, city and state of the account, the user enters contract expiration date, linage rate, lines to date (if any) and status (self-renewing/not self-renewing).

ADS gives you a contract fulfillment program that's easy to use and easy to update and maintain. □

Program Notes

ADS runs on an Altair 8800 with floppy disk, using Altair Extended Disk BASIC V 3.4. Including comments and instructions, it occupies about 15,000 bytes.

The program consists of a command interpreter and several subroutines. Table 2 lists the name and purpose of each subroutine. Structured programming techniques ensure that each routine has only one entrance point and one exit point.

After requesting input, the program checks that

(Continued on following page)

Table 2 – ADS Program Subroutines

Name	Purpose
Date	Check date – change date if desired. If date is changed, all accounts are checked to see if contract has expired
Ads	Enter list of daily ads
Trans	List daily ads
Edit	Edit list of daily ads
Update	Apply transactions (ads) to account file; update the correct monthly sub-total
List	List selected accounts' status
Entry	Enter new permanent account
Help	Get more information on any subroutine
End	Exit the program – closes all files

Table 3 – Account and Kill File Format

Variable Name	String Length	Purpose	Content
T$	3	Valid data indicator	"100"
AC$	4	Account number	1-2000
D$	4	Contract expiration	MMDD
R$	*4	Rate per line	0>Rate≥1$
N$	20	Name	Name
CL$	*4	Contract lines	1>Lines≥500,000
D$(1)	*4	January sub-total	Integer
D$(2)	*4	February sub-total	Integer
D$(3)	*4	March sub-total	Integer
D$(4)	*4	April sub-total	Integer
D$(5)	*4	May sub-total	Integer
D$(6)	*4	June sub-total	Integer
D$(7)	*4	July sub-total	Integer
D$(8)	*4	August sub-total	Integer
D$(9)	*4	September sub-total	Integer
D$(10)	*4	October sub-total	Integer
D$(11)	*4	November sub-total	Integer
D$(12)	*4	December sub-total	Integer
CS$	20	City/State	City/State
AD$	20	Address	Address
SR$	1	Self-renewing	"Y" or "N"

**These variables have string length of 4 because all single precision numbers can be converted to 4-byte strings with the "MKS" function in Altair Disk BASIC. Likewise, the "CVS" function converts these strings to numbers. Single precision numbers have six significant digits; integers up to 999,999 may be represented accurately.*

(Program notes continued)
information was actually entered, and that the input conforms to appropriate limits.

File structure

Four different files appear in the program: account file, transaction file, date file and kill file.

Exact file structure depends on the operating system used. MITS Extended Disk BASIC Rev 3.4, used in this case, supports two types of disk files: random and sequential. Random files use records of 128 characters. Sequential files consist of entries up to 255 characters, in any order.

In random files, each record has associated with it a physical sector number which may range from 1 to 2000 for any particular file and disk. The "field" statement defines the format of the data in a random record. This statement must be executed before information is gotten from or put to a random file.

The date is stored in a sequential file; the accounts, transactions and kills are all stored in random files.

The first three characters of the record of the account and kill files constitute a "valid data indicator", telling the program whether a particular sector is occupied. Account and kill files follow the same format (see Table 3).

Table 4 – Transaction File Format

File Name – Adstemp

Variable Name	Purpose	Content
A$	Depth	1-315
B$	Columns	1-18
C$	Insertions	1-10
D6$	Name	Name
E$	Account number	1-2000

Table 5 – Current Date File Format

File Name – Date

Variable Name	Length	Purpose	Content
ZQ$	6	Date	MMDDYY

Program listing

```
1 REM- ADS PROGRAM V1
2 REM- COPYRIGHT 1978 BY SAM NEWHOUSE
3 REM- INITIALIZE
5 WIDTH 80
10 CLEAR 5000
20 DIM D$(14),B(14)
22 REM- INPUT COMMAND
25 DD$="*":PRINTCHR$(16);CHR$(22);:INPUT"COMMAND ";DD$
28 IF DD$="END" THEN CLOSE:END
30 IF DD$="ENTRY" THEN GOSUB 2000:GOTO 25
32 IF DD$="EDIT" THEN GOSUB 4000:GOTO 25
33 IF DD$="HELP" THEN GOSUB 8200:GOTO25
35 IF DD$="ADS" THEN GOSUB 3000:GOTO 25
36 IF DD$="KILLS" THEN GOSUB 7000:GOTO 25
38 IF DD$="UPDATE" THEN GOSUB 6000:GOTO25
40 IF DD$="LIST" THEN GOSUB 2370:GOTO25
42 IF LEFT$(DD$,5)="TRANS" THEN GOSUB 5000:GOTO 25
45 IF DD$="DATE" THEN GOSUB 9100:GOTO25
47 REM- AN INVALID COMMAND WAS ENTERED
48 GOSUB 8000
50 GOTO 25
2000 REM INPUT NEW ACCOUNT
2005 REM- OPEN MASTER FILE
2010 CLOSE:OPEN "R",#1,"DADS*";1
2012 REM- USE MASTER FIELD STATEMENT
2020 GOSUB 9000
2030 S=0:INPUT"ACCOUNT #";S
2032 REM- IS ACCOUNT # VALID?
2035 IF S<1 OR S>2000 THEN PRINT"INVALID #":GOTO 2030
2040 GET #1,S
2045 REM- IS THERE ALREADY AN ACCOUNT USING THIS NUMBER?
2050 IF RIGHT$(T$,1)="0" THEN PRINT"THAT NUMBER IS ALREADY I
N USE.":PRINT"ACCOUNT NAME-";N$:GOTO2030
2060 A$="*"
2070 INPUT"ACCOUNT NAME ";A$
2080 IF A$="*" THEN 2060
2085 REM- IS NAME TOO LONG?
2090 IF LEN(A$)>20THENPRINT"NAME TOO LONG!":GOTO2060
2091 REM- IS ADDRESS TOO LONG?
2092 INPUT"ADDRESS";AA$:IF LEN(AA$)>20THENPRINT"ADRESS TOO L
ONG!":GOTO2092
2093 REM- IS CITY/STATE TOO LONG?
2094 PRINT"CITY/STATE ";:LINE INPUT BB$:IF LEN(BB$)>20THENPR
INT"CITY/STATE TOO LONG!":GOTO2094
2095 REM- VALID INFORMATION HAS BEEN ENTERED
2096 PRINTCHR$(16);CHR$(22);
2098 REM- DISPLAY NAME AND ADDRESS OF ACCOUNT
2100 PRINT"ACCOUNT NAME-";A$
2102 PRINT"ADDRESS-";TAB(14);AA$
2104 PRINT"CITY/STATE-";TAB(14);BB$
2107 REM- GIVE OPPORTUNITY TO ACCEPT OR REJECT ADDRESS OF NE
W ACCOUNT
2110 YN$="*":INPUT"OK";YN$
2120 IF YN$<>"YES" AND YN$<>"NO" THEN PRINT"PLEASE USE YES O
R NO.":GOTO 2110
2130 IF YN$="YES" THEN 2150
2140 GOTO 2060
2150 N=0
2160 INPUT"CONTRACT LINEAGE";N
2170 IF N=0 THEN 2150
2180 IF N<1 OR N>500000 THEN PRINT"ERROR-RETYPE CONTRACT LIN
EAGE":GOTO 2150
2185 CC$="*":INPUT"SELF-RENEWING (Y/N)";CC$:IF CC$<>"Y" AND
CC$ <>"N" THEN2185
2190 DA$="*"
2200 INPUT"CONTRACT DATE (MMDD) ";DA$
2210 IF DA$="*" THEN 2190
2220 IF LEN(DA$)<>4 THEN PRINT"USE FORMAT MMDD FOR DATE. INS
ERT ZEROS IF NECCESARY.":GOTO 2190
2225 L=999
2230 INPUT"LINEAGE TO DATE";L
2240 IF L=999 THEN 2225
2250 IF L<0 OR L>500000 THEN PRINT"ERROR-RETYPE LINEAGE TO D
ATE.":GOTO 2225
2255 C=0
2260 INPUT"RATE PER LINE IN DOLLARS";C
2270 IF C=0 THEN 2255
2280 IF C<0 OR C>1 THEN PRINT"ERROR-RETYPE RATE.":GOTO 2260
2285 REM- APPLY MASTER FIELD STATEMENT
2290 GOSUB 9000
2295 REM- PUT DATA FOR NEW ACCOUNT INTO FIELD
2297 REM- T$=VALID DATA INDICATOR: N$=NAME: D$=DATE: CL$=CON
TRACT LINES: AC$=ACCOUNT NUMBER: AD$=ADDRESS: CS$=CITY/STATE
```

```
: SR$=SELF RENEWING
2300 LSET T$="100":LSET N$=A$:LSET D$=DA$:LSET D$(1)=MKS$(L)
:LSET CL$=MKS$(N):LSET AC$=STR$(S):LSETAD$=AA$:LSETCS$=BB$:L
SETSR$=CC$
2302  REM- R$=RATE PER LINE
2305 LSET R$=STR$(C)
2308 REM- STORE RECORD ON DISK
2310 PUT #1,S
2315 YN$="*"
2320 INPUT"ANOTHER NEW ACCOUNT";YN$
2325 PRINTCHR$(16);CHR$(22);
2330 IF YN$="*" THEN 2315
2340 IF YN$()"YES" AND YN$()"NO" THEN PRINT"USE YES OR NO.":
GOTO 2315
2350 IF YN$="YES" THEN 2030
2360 RETURN
2370 REM LIST ROUTINE
2375 REM- OPEN MASTER FILE
2380 CLOSE:OPEN "R",#1,"DADS*";1
2390 R1=0:R2=0:INPUT"RANGE OF ACCOUNT NUMBERS (R1,R2)";R1,R2
2391 IF R1=0 OR R2=0 THEN 2390
2392 MF=0:IN=0:INPUT"HOW MANY MONTHS UNTIL EXPIRATION";IN:IF
 IN=0 THEN MF=2
2394 REM- SET DATE RETURN FLAG- PRINT DATE
2396 DR=1:GOSUB9110
2398 REM- SET UP SECTOR COUNTER
2400 FOR S=R1 TO R2
2402 REM- CLEAR SCREEN
2405 PRINTCHR$(16);CHR$(22);
2407 REM- APPLY MASTER FIELD STATEMENT
2410 GOSUB 9000
2412 REM- GET AN ACCOUNT'S RECORD
2418 REM- CHECK IF DATA VALID, IF MONTH FLAG IS SET THEN SKI
P MONTH CHECKING ROUTINE
2420 GET #1,S
2421 IF RIGHT$(T$,1)()"0" THEN 2450
2422 CM$=LEFT$(Z$,2):CM=VAL(CM$):IFMF=2THEN2431
2423 IF CM>9 THEN CM=CM-12
2424 IF CM+IN=>VAL(LEFT$(D$,2)) THEN MF=0 ELSE MF=1
2426 REM- IF AT END OF FILE THEN EXIT THIS ROUTINE
2429 REM- IF CURRENT MONTH + NUMBER OF MONTHS TO EXPIRATION
(IN)< (STORED MONTH) THEN DO NOT LIST THIS ACCOUNT
2430 IF S>R2 THEN RETURN
2431 IF MF=1 THEN 2450
2432 GOSUB 2900
2433 REM- COUNT UP TOTAL LINES FOR YEAR SO FAR
2439 REM- OUTPUT LONG LISTING
2440 PRINT:PRINT:PRINT"DATE-   ";Z$:PRINT"ACCOUNT #";TAB(11)
;AC$:PRINT"NAME";TAB(10);N$:PRINT"ADDRESS";TAB(10);AD$:PRINT
"CITY/STATE";TAB(11);CS$
2441 PRINT"CONTRACT DATE";TAB(20);LEFT$(D$,2)+"/"+RIGHT$(D$,
2):PRINT"CONTRACT LINES";TAB(20);CVS(CL$):PRINT"RATE";TAB(20
);R$
2442 PRINT:PRINT"TOTAL TO DATE";TAB(20);T2
2448 IF SR$="N" THEN PRINT"*** NOT SELF-RENEWING ***":PRINT
2449 IF S>R2 THEN RETURN
2450 NEXT S
2460 RETURN
2899 REM- TOTAL UP LINES TO DATE SUBROUTINE
2900 FOR I=1TO12:D(I)=CVS(D$(I)):NEXTI
2910 T2=0
2920 FOR I=1 TO 12:T2=T2+D(I):NEXT I
2930 RETURN
3000 REM DAILY INPUT ROUTINE
3002 REM- SET TRANSACTION COUNTER TO 0
3005 S1=0
3007 REM- OPEN MASTER FILE
3010 CLOSE:OPEN "R",#1,"DADS*";1
3011 REM- OPEN TRANSACTION FILE
3012 OPEN "R",#3,"ADSTEMP"
3014 S=2001:INPUT"ACCOUNT # (0 IF AT END OF LIST) ";S
3015 REM- VALID ACCOUNT #?
3016 IF S>2000 OR S<0 THEN PRINT"ERROR IN ACCOUNT #":GOTO 30
14
3017 REM- IF S=0 THEN ALL DAILY TRANSACTIONS HAVE BEEN ENTER
ED
3018 IF S=0 THEN GOTO 3120
3019 REM- APPLY MASTER FIELD STATEMENT
3020 GOSUB 9000
3025 REM- GET ACCOUNT'S RECORD
3030 GET #1,S
3035 REM- OUTPUT ACCOUNT NAME
3040 PRINT:PRINT"ACCOUNT NAME- ";N$
3045 REM- CHECK IF THIS IS DESIRED ACCOUNT
3050 YN$="*":INPUT"CORRECT ";YN$
3060 IF YN$="NO" THEN 3014
3070 IF YN$="YES" THEN 3080
3075 PRINT"PLEASE USE 'YES' OR 'NO'.":GOTO 3050
3078 REM- INCREMENT TRANSACTION COUNTER
3080 S1=S1+1
3090 D6=0:INPUT"DEPTH ";D6
3092 IF D6(1 ORD6)315 THEN PRINT"DEPTH ERROR":GOTO3090
3095 D7=0:INPUT"COLUMNS ";D7
3096 IF D7()INT(D7) OR D7(1 OR D7)18 THEN PRINT"ERROR IN COL
UMNS":GOTO3095
3098 D8=1
3099 PRINT:PRINT"LINES=";D6*D7*D8:L9=D6*D7*D8
3100 GOSUB 9200
3101 REM- USE TRANSACTION FILE FIELD STATEMENT
3104 REM- A$=DEPTH: B$=COLUMNS: C$=INSERTIONS: D6$=NAME: E$=
ACCOUNT #
3110 LSET A$=STR$(D6):LSET B$=STR$(D7):LSET C$=STR$(D8):LSET
 D6$=N$:LSET E$=AC$
3112 REM- STORE THIS TRANSACTION IN TRANSACTION FILE ON DISK
3115 PUT #3,S1:GOTO3014
3117 REM- OUTPUT LIST OF TRANSACTIONS
3120 R2=LOF(3)
3130 PRINT:PRINT"NAME";TAB(25);"DEPTH";TAB(40);"COLUMNS";TAB
(50);"INSERTIONS";TAB(62);"TOTAL LINES";TAB(76);"#"
3135 REM- SET UP TRANSACTION COUNTER
3140 FOR S1=1 TO R2
3145 REM- APPLY TRANSACTION FILE FIELD STATEMENT
3150 GOSUB 9200
3155 REM- GET A TRANSACTION
3160 GET #3,S1
3162 IF VAL(B$)(1 OR VAL(B$))18 THEN 3190
3165 REM- TOTAL LINES FOR THIS TRANSACTION
3170 T=VAL(A$)*VAL(B$)*VAL(C$)
3175 REM- PRINT THIS TRANSACTION
3180 PRINTD6$;TAB(25);A$;TAB(40);B$;TAB(50);C$;TAB(64);T;TAB
(75);LOC(3)-1
3185 REM- INCREMENT TRANSACTION COUNTER
3190 NEXT S1
3192 REM- END OF THE TRANSACTION LIST
3195 PRINT:PRINT:PRINTCHR$(7);
3197 REM- CLOSE ALL FILES AND EXIT ROUTINE
3200 CLOSE:RETURN
4000 REM EDIT DAILY ADS LIST
4005 REM- OPEN TRANSACTION FILE
4010 CLOSE:OPEN "R",#3,"ADSTEMP"
4020 T=0:INPUT"WHICH TRANSACTION TO MODIFY ";T
4025 IF T(1 OR T)2000 THEN PRINT"ACCOUNT # ERROR":GOTO4020
4028 REM- APPLY TRANSACTION FILE FIELD DTATEMENT
4030 GOSUB 9200
4035 REM- GET SELECTED TRANSACTION- SET E1$=ACCOUNT NUMBER
4040 GET #3,T:E1$=E$
4045 REM- PRINT SELECTED TRANSACTION
4050 PRINTCHR$(16);CHR$(22);"TRANSACTION # ";LOC(3)-1:PRINT"
NAME- ";D6$
4055 PRINT"ACCOUNT # ";E$
4060 PRINT"DEPTH- ";A$
4070 PRINT"COLUMNS- ";B$
4090 PRINT:PRINT
4100 YN$="*":INPUT"WANT TO CHANGE THIS TRANSACTION ";YN$
4105 IF YN$="YES" THEN 4120
4110 IF YN$="NO" THEN 4190
```

(Continued on following page)

Program Listing continued

```
4115 PRINT"PLEASE USE 'YES' OR 'NO'":GOTO4100
4120 PRINT"TRANSACTION # ";LOC(3)-1:S=0:INPUT"ACCOUNT # ";S:
IFS(1 OR S)2000 THENPRINT"ACCOUNT # ERROR":GOTO4120
4121 REM- OPEN MASTER FILE- GET NAME OF ACCOUNT
4122 CLOSE 1:OPEN "R",#1,"DADS*",1:GOSUB9000:GET#1,S
4123 REM- PRINT ACCOUNT NAME
4125 PRINT"NAME- ";N$
4126 YN$="*":INPUT"CORRECT ";YN$:IFYN$()"NO" AND YN$()"YES"
THEN 4126
4127 IFYN$="NO" THEN 4120
4136 B6=0:INPUT"DEPTH- ";D6
4140 IF D6(1 OR D6)315 THEN PRINT"DEPTH ERROR!":GOTO4136
4145 REM- SET E1$=ACCOUNT NUMBER
4147 E1$=AC$
4150 D7=0:INPUT"COLUMNS- ";D7
4155 IF D7(1 OR D7)18 THEN PRINT"COLUMNS ERROR":GOTO4150
4165 D8=1
4167 REM- OPEN TRANSACTION FILE
4168 CLOSE 3:OPEN "R",#3,"ADSTEMP"
4169 GOSUB 9200
4170 LSET A$=STR$(D6):LSET B$=STR$(D7):LSET C$=STR$(D8):LSET
 D6$=N$:LSET E$=E1$
4175 REM- A$=DEPTH: B$=COLUMNS: C$=INSERTIONS: D6$=NAME: E$=
ACCOUNT NUMBER
4179 REM- STORE CORRECTED TRANSACTION ON DISK
4180 PUT #3,T
4190 YN$="*":INPUT"MODIFY ANOTHER TRANSACTION ";YN$
4195 IF YN$="NO" THEN CLOSE:RETURN
4196 IF YN$="YES" THEN PRINTCHR$(16);CHR$(22);:GOTO4020
4197 PRINT"PLEASE USE 'YES' OR 'NO'":GOTO4190
5000 REM LIST TRANSACTIONS ROUTINE
5005 REM- OPEN TRANSACTION FILE
5010 CLOSE 3:OPEN "R",#3,"ADSTEMP"
5015 REM- SET UP TRANSACTION COUNTER
5020 FORS=1 TO LOF(3)
5022 REM- CLEAR SCREEN
5025 PRINTCHR$(16);CHR$(22);
5027 REM- GET A TRANSACTION FROM DISK
5030 GOSUB 9200:GET #3,S
5035 REM- SET B=COLUMNS: CHECK FOR VALID RECORD
5040 B=VAL(B$):IF B(1 OR B)18 THEN 5120
5045 REM- PRINT THE TRANSACTION
5050 PRINT:PRINT"TRANSACTION # ";LOC(3)-1:PRINT"NAME-";TAB(1
0);D6$
5060 PRINT"ACCOUNT #";TAB(10);E$
5070 PRINT"DEPTH-";TAB(10);A$
5080 PRINT"COLUMNS-"TAB(10);B$
5095 L=VAL(A$)*VAL(B$)*VAL(C$)
5100 PRINT"TOTAL LINES-";L
5110 REM- INCREMENT TRANSACTION COUNTER
5115 INPUT A$
5120 NEXT S
5130 RETURN
6000 REM UPDATE ACCOUNT FILE
6010 CLOSE
6015 REM- OPEN MASTER FILE
6020 OPEN "R",#1,"DADS*",1
6025 REM- OPEN DATE FILE
6030 OPEN "I",#2,"DATE*"
6035 REM- OPEN TRANSACTION FILE
6040 OPEN "R",#3,"ADSTEMP"
6045 REM- GET DATE
6050 INPUT #2,Z$
6055 REM- SET UP TRANSACTION COUNTER
6060 FOR T=1TOLOF(3)
6065 REM- APPLY TRANSACTION FIELD STATEMENT
6070 GOSUB 9200
6075 REM- GET TRANSACTION
6080 GET #3,T
6085 REM- IS TRANSACTION VALID?
6090 IF VAL(B$)(1 OR VAL(B$))18 THEN 6140
6095 REM- TOTAL LINES FOR THIS TRANSACTION
6100 L=VAL(A$)*VAL(B$)*VAL(C$)
6105 REM- APPLY MASTER FIELD STATEMENT- GET ACCOUNT LISTED I
N THE TRANSACTION
6110 GOSUB 9000:GET #1,VAL(E$)
6115 REM- ADD LINES FOR THIS TRANSACTION TO MONTH OF ACCOUNT
S FILE WHICH IS SAME AS CURRENT MONTH
6120 I=VAL(LEFT$(Z$,2)):D(I)=CVS(D$(I)):D(I)=D(I)+L:LSET D$(
I)=MKS$(D(I))
6125 REM- STORE REVISED ACCOUNT IN ITS OLD LOCATION
6130 PUT #1,VAL(E$)
6135 REM- INCREMENT TRANSACTION COUNTER
6140 NEXT T
6145 REM- AFTER ALL TRANSACTIONS HAVE BEEN PROCESSED,KILL TH
E TRANSACTION FILE. THIS AVOIDS COUNTING THE SAME ADS TWICE.
6147 CLOSE:KILL"ADSTEMP"
6150 RETURN
7000 REM- DISPLAY KILLS
7010 CLOSE:OPEN "R",#1,"KILL*",1
7020 FOR S=1 TO LOF(1)
7030 GOSUB 9000
7040 GET #1,S
7050 IF T$()"100" THEN 7170
7060 PRINT
7070 PRINT"NAME-";N$
7080 PRINT"ACCOUNT #-";AC$
7090 PRINT"MONTHLY SUB-TOTALS"
7100 PRINT"JAN.-";CVS(D$(1));TAB(20);"FEB.-";CVS(D$(2));TAB(
40);"MAR.-";CVS(D$(3))
7110 PRINT"APR.-";CVS(D$(4));TAB(20);"MAY-";CVS(D$(5));TAB(4
0);"JUNE-";CVS(D$(6))
7120 PRINT"JULY-";CVS(D$(7));TAB(20);"AUG.-";CVS(D$(8));TAB(
40);"SEP.-";CVS(D$(9))
7130 PRINT"OCT.-";CVS(D$(10));TAB(20);"NOV.-";CVS(D$(11));TA
B(40);"DEC.-";CVS(D$(12))
7140 GOSUB 2900
7150 PRINT"TOTAL FOR YEAR-";T2
7160 PRINT:NEXT S
7170 RETURN
8000 REM- LIST AVAILABLE COMMANDS
8010 REM- CLEAR SCREEN
8020 PRINTCHR$(16);CHR$(22);
8030 PRINT"*** ADS PROGRAM ***"
8040 PRINT"*** COMMANDS AVAILABLE:"
8050 PRINT"COMMAND";TAB(10);"FUNCTION"
8060 PRINT"----------------------------"
8070 PRINT"1. DATE";TAB(10);"GET/CHANGE THE DATE"
8080 PRINT"2. ADS";TAB(10);"TODAYS TRANSACTIONS"
8090 PRINT"3. TRANS";TAB(10);"LIST TRANSACTIONS"
8100 PRINT"4. EDIT";TAB(10);"EDIT TRANSACTIONS"
8110 PRINT"5. UPDATE";TAB(10);"UPDATE THE ACCOUNTS"
8120 PRINT"6. LIST";TAB(10);"PRINT ACCOUNTS STATUS"
8130 PRINT"7. ENTRY";TAB(10);"ENTER NEW ACCOUNT"
8140 PRINT"8. HELP";TAB(10);"MORE INFORMATION"
8150 PRINT"9. END";TAB(10);"EXIT THE PROGRAM"
8153 PRINT"10.KILLS";TAB(10);"LIST ALL KILLS"
8155 IF HF=1 THEN HF=0:GOTO8230
8160 INPUT A$
8165 RETURN
8200 REM- HELP SECTION
8205 HF=1:REM- SET HELP FLAG
8210 PRINTCHR$(16);CHR$(22);
8220 GOTO 8020
8230 CD=0:INPUT"INFO ON WHICH #";CD
8240 IF CD=0 THEN 8230
8250 IF CD)9 THEN PRINT"USE NUMBERS 1 THROUGH 9.":GOTO 8230
8255 PRINTCHR$(16);CHR$(22);
8260 ON CD GOTO 8300,8400,8450,8500,8600,8650,8700,8800,8900
8300 PRINT"1. DATE";TAB(10);"GET/CHANGE THE DATE"
8310 PRINT"THIS COMMAND AFFECTS TODAYS":PRINT"DATE WHICH THE
 COMPUTER STORES":PRINT"AND USES IN DETERMINING WHAT"
8315 PRINT"MONTH TO CREDIT THE LINEAGE":PRINT"OF A TRANSACTI
ON."
8318 PRINT"ALSO,EVERY TIME THE DATE IS":PRINT"CHANGED,THE CO
MPUTER CHECKS":PRINT"EVERY CONTRACT TO SEE IF IT HAS":PRINT"
```

```
EXPIRED."
8320 GOTO 8950
8400 PRINT"2. ADS";TAB(10);"TODAYS TRANSACTIONS":PRINT"USE T
HIS  TO ENTER TODAYS":PRINT"LIST OF ADS(TRANSACTIONS). FOR":
PRINT"EACH AD,YOU ENTER THE ACCOUNT"
8410 PRINT"NUMBER,DEPTH,COLUMNS,AND":PRINT"NUMBER OF INSERTI
ONS.":PRINT"DEPTH CANNOT EXCEED 315":PRINT"LINES.COLUMNS CAN
NOT EXCEED 18."
8415 PRINT"NO MORE THAN 10 INSERTIONS PER":PRINT"AD. WHEN AL
L ADS  ARE ENTERED,":PRINT"ENTER 0(ZERO) AS THE ACCOUNT #."
8420 GOTO 8950
8450 PRINT"3. TRANS";TAB(10);"LIST TRANSACTIONS":PRINT"FOR E
ACH STORED TRANSACTION":PRINT"(AD),THE DEPTH,COLUMNS":PRINT"
INSERTIONS,TOTAL LINES,ACCOUNT":PRINT"NAME AND NUMBER WILL B
E PRINTED.":GOTO8950
8500 PRINT"4. EDIT";TAB(10);"EDIT TRANSACTIONS":PRINT"THIS C
OMMAND ALLOWS YOU TO EDIT":PRINT"ONE TRANSACTION.THE CURRENT
"
8510 PRINT"TRANSACTION IS PRINTED. ":PRINT"IF YOU WANT TO CH
ANGE THE":PRINT"TRANSACTION, YOU RE-ENTER IT.":PRINT"ACCOUNT
 NUMBERS MUST BE BETWEEN":PRINT"1 AND 2000."
8530 GOTO 8950
8600 PRINT"5. UPDATE";TAB(10);"UPDATE THE ACCOUNTS":PRINT"AP
PLY THE LIST OF TRANSACTIONS":PRINT"TO THE ACCOUNT FILE. AFT
ER ALL":PRINT"ACCOUNTS ARE UPDATED,KILL ":PRINT"THE TRANSACT
IONS SO THEY CANNOT":PRINT"BE COUNTED TWICE.":GOTO8950
8650 PRINT"6. LIST";TAB(10);"PRINT ACCOUNTS STATUS":PRINT"TH
IS COMMAND LISTS THE NAME,":PRINT"CONTRACT DATE,CONTRACT LIN
ES,":PRINT"RATE PER LINE,AND LINES TO":PRINT"DATE FOR EACH S
ELECTED ACCOUNT."
8660 PRINT"IT WILL LIST ACCOUNTS WHICH ARE":PRINT"WITHIN A D
ESIGNATED NUMBER OF":PRINT"MONTHS FROM EXPIRATION. IF YOU":P
RINT"SPECIFY 0(ZERO) MONTHS FROM":PRINT"EXPIRATION, ALL ACCO
UNTS":PRINT"WILL BE LISTED."
8680 GOTO8950
8700 PRINT"7. ENTRY";TAB(10);"ENTER NEW ACCOUNT"
8710 PRINT"THIS COMMAND ALLOWS YOU TO":PRINT"ADD A NEW ACCOU
NT TO THE FILE.":PRINT"YOU INPUT THE NAME,ADDRESS,":PRINT"CO
NTRACT EXPIRATION DATE,LINES,":PRINT"AND RATE, AND THE NUMBE
R OF"
8720 PRINT"LINES TO DATE (IF ANY)."
8730 GOTO8950
8800 GOTO 8200
8900 PRINT"9. END";TAB(10);"EXIT THE PROGRAM"
8910 PRINT"USE THIS COMMAND WHEN YOU ARE":PRINT"THROUGH FOR
THE DAY. ALL":PRINT"FILES WILL BE CLOSED."
8950 YN$="*":INPUT"WANT MORE HELP";YN$
8955 IF YN$="YES" THEN 8200
8960 IF YN$="NO" THEN RETURN
8965 PRINT"USE 'YES' OR 'NO'.":GOTO 8950
9000 REM MASTER FIELD STATEMENT
9010 FIELD #1,3AS T$,4AS AC$,4AS D$,4AS R$,20AS N$,4AS CL$,4
AS D$(1),4AS D$(2),4AS D$(3),4AS D$(4),4AS D$(5),4AS D$(6),4
AS D$(7),4AS D$(8),4AS D$(9),4AS D$(10),4AS D$(11),4AS D$(12
),20AS CS$,20AS AD$,1AS SR$
9020 RETURN
9100 REM DATE CHECK AND RESET ROUTINE
9101 GOTO 9110
9102 OPEN "O",#1,"DATE*"
9104 PRINT #1,"000000";
9106 CLOSE:STOP
9107 REM- ABOVE ROUTINE IS USED ONLY WHEN INITIALIZING DATE
FOR THE FIRST TIME
9108 REM- OPEN DATE FILE
9110 CLOSE 2 :OPEN "I",#2,"DATE*"
9115 REM- GET STORED CURRENT DATE
9120 INPUT #2,ZQ$
9125 REM- CLEAR SCREEN
9130 PRINTCHR$(16);CHR$(22);
9135 REM- PRINT DATE
9140 PRINT"DATE-   ";:Z$=LEFT$(ZQ$,2)+"/"+MID$(ZQ$,3,2)+"/"+
RIGHT$(ZQ$,2):PRINTZ$
9141 CLOSE 2
9142 REM- IF DATE FLAG SET THEN RESET IT AND RETURN TO LINE
2396
9145 IF DR=1 THEN DR=0:RETURN
9150 YN$="*":PRINT:INPUT"WANT TO CHANGE DATE";YN$
9160 IF YN$="YES" THEN 9170
9165 IF YN$="NO" THEN CLOSE:RETURN
9167 GOTO 9150
9169 REM- OPEN DATE FILE
9170 CLOSE:OPEN"O",#2,"DATE*"
9172 REM- INPUT NEW DATE
9175 ZZ$="*":INPUT"MONTH";ZZ$
9180 ZY$="*":INPUT"DAY";ZY$
9185 ZX$="*": INPUT"YEAR";ZX$
9187 ZX$=RIGHT$(ZX$,2)
9188 REM- IS DATE VALID?
9190 Z$=ZZ$+ZY$+ZX$:IF LEN(Z$)<>6 THEN PRINT"DATE ERROR!":GO
TO9175
9192 REM- OUTPUT NEW DATE TO DATE FILE, CLOSE DATE FILE
9195 PRINT #2,Z$;:CLOSE 2
9198 GOTo 9400
9199 REM- TRANSACTION FIELD STATEMENT
9200 FIELD #3,10 AS A$,10 AS B$,10 AS C$,20 AS D6$,4 AS E$
9210 RETURN
9395 REM- CHECK FOR EXPIRED CONTRACTS
9399 REM- INITIALIZE SECTOR(ACCOUNT) COUNTER
9400 S=1
9402 REM- OPEN DATE AND MASTER FILES
9405 CLOSE: OPEN "R",#1,"DADS*",1:OPEN "I",#2,"DATE*"
9406 REM- GET CURRENT DATE FROM DATE FILE
9407 INPUT #2,ZQ$
9408 REM-APPLY MASTER FIELD STATEMENT
9410 GOSUB 9000
9415 REM- GET ACCOUNT FROM MASTER FILE
9420 GET #1,S
9425 REM- IF AT END OF ACCOUNTS THEN EXIT THIS ROUTINE
9430 IF S=LOF(1) THEN CLOSE:RETURN
9435 REM- IS DATA IN MASTER FILE VALID?
9440 IF RIGHT$(T$,1)()"0" THEN S=S+1:GOTO9410
9445 REM- D1=STORED MONTH: D2=STORED DAY
9450 D1=VAL(LEFT$(D$,2)):D2=VAL(RIGHT$(D$,2))
9460 REM- D3=CURRENT MONTH: D4=CURRENT DAY
9470 D3=VAL(LEFT$(ZQ$,2)):D4=VAL(MID$(ZQ$,3,2))
9475 REM- HAS CONTRACT EXPIRATION DATE BEEN REACHED?
9480 IF D1=D3 AND (D4=D2 OR D4=D2+1 OR D4=D2+2 OR D4=D2+3) T
HEN 9600
9485 REM- INCREMENT ACCOUNT COUNTER
9490 S=S+1:GOTO9410
9495 REM- PRINT DETAILS ON AN EXPIRED CONTRACT
9600 PRINTCHR$(16);CHR$(22);:PRINT:PRINT
9610 PRINT"ACCOUNT # ";S
9620 PRINT"NAME- ";N$
9625 REM- COUNT UP TOTAL LINES FOR YEAR
9630 GOSUB 2900
9640 PRINT"TOTAL LINES FOR YEAR- ";T2
9642 YN$="*":INPUT"WANT TO ZERO THIS ACCOUNT";YN$
9644 IF YN$="YES" THEN 9650
9646 IF YN$="NO" THEN 9677
9648 PRINT"USE 'YES' OR 'NO'.":GOTO9642
9650 PRINT"NOW ZEROING THIS ACCOUNT"
9652 FIELD #1,128 AS A$:GET #1,S:AK$=A$
9655 REM- ZERO MONTHLY TOTALS FOR THIS ACCOUNT
9657 GOSUB 9000:GET#1,S
9660 FORI=1TO12:LSET D$(I)=MKS$(0):NEXTI
9670 PUT #1,S
9673 CLOSE:OPEN "R",#1,"KILL*",1:K=1
9674 FIELD #1,128 AS A$:GET #1,K:IF LEFT$(A$,3)="100" THEN K
=K+1:GOTO9674
9675 LSET A$=AK$:PUT #1,K:CLOSE:OPEN "R",#1,"DADS*",1
9676 REM- INCREMENT ACCOUNT COUNTER
9677 S=S+1
9680 GOTO 9410

OK
```

Commands and Options Available

Ads (input the day's list of ads)
Enter the account number of the ad. The program prints the name of the account for verification.

Then enter depth and columns. Depth must be greater than 0 and less than 316; columns must be greater than 0 and less than 19.

Next, enter another ad. When all ads have been entered, input 0 (zero) as the account number. Ads for that day are printed out, and control returns to the Options Menu.

Trans (lists today's transactions)
This command prints out the list of ads entered for that day. For each ad, the account name, account number, transaction number, depth and columns are printed.

Edit (edit today's transactions)
First, you're asked which transaction number you want to modify. When that transaction is printed, you're asked to confirm whether you want to modify it. If you say yes, a new account number is entered. That account's name is displayed for verification; then depth and columns are entered.

Update (apply transactions to accounts file)
The program adds each transaction to the current monthly sub-total of the appropriate account, then deletes the transactions.

List (lists status of accounts)
You're asked the range of accounts you want printed. Then you're asked "How many months until expiration?" If you respond "2", for example, all contracts expiring in the current month and the next two months are listed. If you respond 0 (zero) all accounts in the designated range are printed.

Entry (enter a new account)
Input the account number of the new account. The computer checks that the account number is not already in use. If the account number is already in use, the name of the account using it is displayed and you input a new account number. If the number is not in use, input the name and address of the account. The computer prints this information for verification. Then you enter contract linage, contract expiration date, lines to date, rate per line and type of contract.

Date (check and reset current date)
This command displays the stored current date, which you may change.

If you change the date, the computer checks all contracts against the stored current date. If the current date equals the contract date, or if the current date is greater than the contract date by up to three days, details of that account are displayed, and you decide whether to zero that account. If the account is zeroed, the old status of the account is stored in a killed accounts file.

Kill (lists killed accounts)
For each account in the killed accounts file, the name, account number, monthly sub-totals and total for the contract year are displayed.

Help (get more information)
The computer displays a menu of information available and you choose the item you want printed.

Notes On Sample Runs

Note that all operator input is echoed twice – a hardware peculiarity only.

In Sample Run 1, a listing of the first 10 accounts is requested. (Note: all account information is fictitious.) Then another listing of accounts expiring within the next two months is requested.

Next, a list of daily ads is input. A "depth error" occurred in the second ad when depth exceeded 315 lines. Also a "columns error" resulted when columns exceeded 18.

After entering the last ad, the operator types "0" (zero) for account number. Then the computer automatically prints a table of ads.

Next, Transaction 4 is edited, changing the columns from 6 to 10. Another list of ads verifies the change.

The update command applies the stored list of ads to the account file. Another listing of accounts proves that each accounts' totals were updated properly.

Sample Run 2 starts with a new date entered as the current date.

The program notices that the contract of Account #4, Paper World, has expired and prints total lines for the year. The operator chooses to zero the account, so the account's status is stored in the permanent kills file.

Then the computer prints the kills file, which at this point contains only the Paper World account.

Next, a new account is entered into the accounts file, then listed. Another list of ads is entered, listed, and applied to the accounts file. Finally, the program prints new status of the accounts.

Sample Runs

Sample Run 1

```
RRUUNN""AADDSS11
COMMAND ? HHUUHH??
*** ADS PROGRAM ***
*** COMMANDS AVAILABLE:
COMMAND   FUNCTION
---------------------------
1. DATE   GET/CHANGE THE DATE
2. ADS    TODAYS TRANSACTIONS
3. TRANS  LIST TRANSACTIONS
4. EDIT   EDIT TRANSACTIONS
5. UPDATE UPDATE THE ACCOUNTS
6. LIST   PRINT ACCOUNTS STATUS
7. ENTRY  ENTER NEW ACCOUNT
8. HELP   MORE INFORMATION
9. END    EXIT THE PROGRAM
10.KILLS  LIST ALL KILLS
?
COMMAND ? DDAATTEE
DATE-   02/09/78

WANT TO CHANGE DATE? YYEESS
MONTH? 0022
DAY? 1133
YEAR? 7788
COMMAND ? LLIISSTT
RANGE OF ACCOUNT NUMBERS (R1;R2)? 11;;1100
HOW MANY MONTHS UNTIL EXPIRATION? 00
DATE-   02/13/78


DATE-   02/13/78
ACCOUNT #   1
NAME      DYNAMIC DOMESTIC
ADDRESS   2828 KENNEDY BLVD.
CITY/STATE JERSEY CITY,N.J.
CONTRACT DATE       04/15
CONTRACT LINES       50000
RATE                 .49

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   2
NAME      DAVIS TOYS
ADDRESS   32ND ST.
CITY/STATE UNION CITY, N.J.
CONTRACT DATE       06/21
CONTRACT LINES       2000
RATE                 .46

TOTAL TO DATE        0




DATE-   02/13/78
ACCOUNT #   3
NAME      HABAND
ADDRESS   265 N. 9TH
CITY/STATE PATTERSON, N.J.
CONTRACT DATE       04/01
CONTRACT LINES       12000
RATE                 .51

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   4
NAME      PAPER WORLD
ADDRESS   113 ENTERPRISE
CITY/STATE SECAUCUS,N.J.
CONTRACT DATE       03/21
CONTRACT LINES       4000
RATE                 .53

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   5
NAME      RELIABLE FURNITURE
ADDRESS   310 JACKSON AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE       05/30
CONTRACT LINES       4000
RATE                 .49

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   6
NAME      ROGERS CLOTHES
ADDRESS   113 BROAD ST.
CITY/STATE ELIZABETH, N.J.
CONTRACT DATE       11/20
CONTRACT LINES       12000
RATE                 .51

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   7
NAME      SCHLESINGEER
ADDRESS   BERGENLINE AVE.
CITY/STATE W. NEW YORK, N.J.
CONTRACT DATE       10/01
CONTRACT LINES       150000
RATE                 .4

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   8
NAME      SINGER SEWING
ADDRESS   747 5TH AVE.
CITY/STATE N.Y.C., N.Y.
CONTRACT DATE       01/01
CONTRACT LINES       4000
RATE                 .51

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   9
NAME      SYLVETTE GLADSTONE
ADDRESS   135 NEWARK AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE       03/30
CONTRACT LINES       200000
RATE                 .46

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   10
NAME      BRAVERMAN
ADDRESS   770 WEST SIDE AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE       10/06
CONTRACT LINES       35000
RATE                 .49


TOTAL TO DATE        0
COMMAND ? LLIISSTT
RANGE OF ACCOUNT NUMBERS (R1;R2)? 11;;1100
HOW MANY MONTHS UNTIL EXPIRATION? 22
DATE-   02/13/78


DATE-   02/13/78
ACCOUNT #   1
NAME      DYNAMIC DOMESTIC
ADDRESS   2828 KENNEDY BLVD.
CITY/STATE JERSEY CITY,N.J.
CONTRACT DATE       04/15
CONTRACT LINES       50000
RATE                 .49

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   3
NAME      HABAND
ADDRESS   265 N. 9TH
CITY/STATE PATTERSON, N.J.
CONTRACT DATE       04/01
CONTRACT LINES       12000
RATE                 .51

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   4
NAME      PAPER WORLD
ADDRESS   113 ENTERPRISE
CITY/STATE SECAUCUS,N.J.
CONTRACT DATE       03/21
```

(Continued on following page)

Sample Run 1 continued

```
CONTRACT LINES       4000
RATE                 .53

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   8
NAME      SINGER SEWING
ADDRESS   747 5TH AVE.
CITY/STATE N.Y.C., N.Y.
CONTRACT DATE        01/01
CONTRACT LINES       4000
RATE                 .51

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   9
NAME      SYLVETTE GLADSTONE
ADDRESS   135 NEWARK AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE        03/30
CONTRACT LINES       200000
RATE                 .46

TOTAL TO DATE        0

COMMAND ? AADDSS
ACCOUNT # (0 IF AT END OF LIST) ? 33

ACCOUNT NAME- HABAND
CORRECT ? YY
PLEASE USE 'YES' OR 'NO'.
CORRECT ? YYEESS
DEPTH ? 5500
COLUMNS ? 88

LINES= 400
ACCOUNT # (0 IF AT END OF LIST) ? 44

ACCOUNT NAME- PAPER WORLD
CORRECT ? YYEESS
DEPTH ? 440000
DEPTH ERROR
DEPTH ? 330000
COLUMNS ? 2200
ERROR IN COLUMNS
COLUMNS ? 88

LINES= 2400
ACCOUNT # (0 IF AT END OF LIST) ? 55

ACCOUNT NAME- RELIABLE FURNITURE
CORRECT ? YYEESS
DEPTH ? 6600
COLUMNS ? 22

LINES= 120
ACCOUNT # (0 IF AT END OF LIST) ? 66

ACCOUNT NAME- ROGERS CLOTHES
CORRECT ? YYEESS
DEPTH ? 330000
COLUMNS ? 66

LINES= 1800
ACCOUNT # (0 IF AT END OF LIST) ? 77

ACCOUNT NAME- SCHLESINGEER
CORRECT ? YYEESS
DEPTH ? 8800
COLUMNS ? 1100


LINES= 800
ACCOUNT # (0 IF AT END OF LIST) ? 77

ACCOUNT NAME- SCHLESINGEER
CORRECT ? YYEESS
DEPTH ? 8800
COLUMNS ? 66

LINES= 480
ACCOUNT # (0 IF AT END OF LIST) ? 88

ACCOUNT NAME- SINGER SEWING
CORRECT ? YYEESS
DEPTH ? 110000
COLUMNS ? 1100

LINES= 1000
ACCOUNT # (0 IF AT END OF LIST) ? 00

COMMAND ?
         EEDDIITT
WHICH TRANSACTION TO MODIFY ? 33
TRANSACTION #  3
NAME- RELIABLE FURNITURE
ACCOUNT #  5
DEPTH-  60
COLUMNS-  2


WANT TO CHANGE THIS TRANSACTION ? MMMM
PLEASE USE 'YES' OR 'NO'
WANT TO CHANGE THIS TRANSACTION ? NNOO
MODIFY ANOTHER TRANSACTION ? YYEESS
WHICH TRANSACTION TO MODIFY ? 44
TRANSACTION #  4
NAME- ROGERS CLOTHES
ACCOUNT #  6
DEPTH-  300
COLUMNS-  6


WANT TO CHANGE THIS TRANSACTION ? YYEESS
TRANSACTION #  4
ACCOUNT # ? 66
NAME- ROGERS CLOTHES
CORRECT ? YYEESS
DEPTH- ? 330000
COLUMNS- ? 1100
MODIFY ANOTHER TRANSACTION ? NNOO
COMMAND ? TTRRAANNSS

TRANSACTION #  1
NAME-     HABAND
ACCOUNT #  3
DEPTH-     50
COLUMNS-   8
TOTAL LINES- 400
?
TRANSACTION #  2
NAME-     PAPER WORLD
ACCOUNT #  4
DEPTH-     300
COLUMNS-   8
TOTAL LINES- 2400
?

TRANSACTION #  3
NAME-     RELIABLE FURNITURE
ACCOUNT #  5
DEPTH-     60
COLUMNS-   2
TOTAL LINES- 120
?

TRANSACTION #  4
NAME-     ROGERS CLOTHES
ACCOUNT #  6
DEPTH-     300
COLUMNS-   10
```

NAME	DEPTH	COLUMNS	INSERTIONS	TOTAL LINES	#
HABAND	50	8	1	400	1
PAPER WORLD	300	8	1	2400	2
RELIABLE FURNITURE	60	2	1	120	3
ROGERS CLOTHES	300	6	1	1800	4
SCHLESINGEER	80	10	1	800	5
SCHLESINGEER	80	6	1	480	6
SINGER SEWING	100	10	1	1000	7

```
TOTAL LINES- 3000
?

TRANSACTION #  5
NAME-     SCHLESINGEER
ACCOUNT #  7
DEPTH-     80
COLUMNS-   10
TOTAL LINES- 800
?

TRANSACTION #  6
NAME-     SCHLESINGEER
ACCOUNT #  7
DEPTH-     80
COLUMNS-   6
TOTAL LINES- 480
?


TRANSACTION #  7
NAME-     SINGER SEWING
ACCOUNT #  8
DEPTH-     100
COLUMNS-   10
TOTAL LINES- 1000
?
COMMAND ? UUPPDDAATTEE
COMMAND ? LLIISSTT
RANGE OF ACCOUNT NUMBERS (R1,R2)
HOW MANY MONTHS UNTIL EXPIRATION? 00
DATE-   02/13/78


DATE-   02/13/78
ACCOUNT #   1
NAME      DYNAMIC DOMESTIC
ADDRESS   2828 KENNEDY BLVD.
```

```
CITY/STATE JERSEY CITY,N.J.
CONTRACT DATE        04/15
CONTRACT LINES       50000
RATE                 .49

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   2
NAME      DAVIS TOYS
ADDRESS   32ND ST.
CITY/STATE UNION CITY, N.J.
CONTRACT DATE        06/21
CONTRACT LINES       2000
RATE                 .46

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   3
NAME      HABAND
ADDRESS   265 N. 9TH
CITY/STATE PATTERSON, N.J.
CONTRACT DATE        04/01
CONTRACT LINES       12000
RATE                 .51

TOTAL TO DATE        400


DATE-   02/13/78
ACCOUNT #   4
NAME      PAPER WORLD
ADDRESS   113 ENTERPRISE
CITY/STATE SECAUCUS,N.J.
CONTRACT DATE        03/21
CONTRACT LINES       4000
RATE                 .53

TOTAL TO DATE        2400


DATE-   02/13/78
ACCOUNT #   5
NAME      RELIABLE FURNITURE
ADDRESS   310 JACKSON AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE        05/30
CONTRACT LINES       4000
RATE                 .49

TOTAL TO DATE        120


DATE-   02/13/78
ACCOUNT #   6
NAME      ROGERS CLOTHES
ADDRESS   113 BROAD ST.
CITY/STATE ELIZABETH, N.J.
CONTRACT DATE        11/20
CONTRACT LINES       12000
RATE                 .51

TOTAL TO DATE        3000


DATE-   02/13/78
ACCOUNT #   7
NAME      SCHLESINGEER
ADDRESS   BERGENLINE AVE.
CITY/STATE W. NEW YORK, N.J.
CONTRACT DATE        10/01
CONTRACT LINES       150000
RATE                 .4

TOTAL TO DATE        1280


DATE-   02/13/78
ACCOUNT #   8
NAME      SINGER SEWING
ADDRESS   747 5TH AVE.
CITY/STATE N.Y.C., N.Y.
CONTRACT DATE        01/01
CONTRACT LINES       4000
RATE                 .51

TOTAL TO DATE        1000


DATE-   02/13/78
ACCOUNT #   9
NAME      SYLVETTE GLADSTONE
ADDRESS   135 NEWARK AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE        03/30
CONTRACT LINES       200000
RATE                 .46

TOTAL TO DATE        0


DATE-   02/13/78
ACCOUNT #   10
NAME      BRAVERMAN
ADDRESS   770 WEST SIDE AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE        10/06
CONTRACT LINES       35000
RATE                 .49

TOTAL TO DATE        0
COMMAND ? EENNDD

OK
```

Sample Run 2

```
RRUUNN""AADDSS11
COMMAND ? DDAATTEE
DATE-   02/13/78

WANT TO CHANGE DATE? YYEESS
MONTH? 0033
DAY? 2222
YEAR? 7788


ACCOUNT #  4
NAME- PAPER WORLD
TOTAL LINES FOR YEAR-  2400
WANT TO ZERO THIS ACCOUNT? WWWW
USE 'YES' OR 'NO'.
WANT TO ZERO THIS ACCOUNT? YYEESS
NOW ZEROING THIS ACCOUNT
COMMAND ? LLIISSTT
RANGE OF ACCOUNT NUMBERS (R1,R2)? 44,,44
HOW MANY MONTHS UNTIL EXPIRATION? 00
DATE-   03/22/78


DATE-   03/22/78
ACCOUNT #   4
NAME      PAPER WORLD
ADDRESS   113 ENTERPRISE
CITY/STATE SECAUCUS,N.J.
CONTRACT DATE        03/21
CONTRACT LINES       4000
RATE                 .53

TOTAL TO DATE        0
COMMAND ? KKIILLLLSS .

NAME-PAPER WORLD
ACCOUNT #- 4
MONTHLY SUB-TOTALS
JAN.- 0          FEB.- 2400       MAR.- 0
APR.- 0          MAY- 0           JUNE- 0
JULY- 0          AUG.- 0          SEP.- 0
OCT.- 0          NOV.- 0          DEC.- 0
TOTAL FOR YEAR- 2400

COMMAND ? EENNTTRRYY
ACCOUNT #? 1111
ACCOUNT NAME ? MMRR..
ADDRESS?
CITY/STATE
ACCOUNT NAME-MR.
ADDRESS-
CITY/STATE-
OK? NNOO
ACCOUNT NAME ? MMRR..  PPAANNEELL
ADDRESS? CCIITTYYLLIINNEE  PPLL..
CITY/STATE BBAAYYOONNNNEE,,  NN..JJ..
ACCOUNT NAME-MR. PANEL
ADDRESS-      CITYLINE PL.
CITY/STATE-   BAYONNE, N.J.
OK? YYEESS
CONTRACT LINEAGE? 2200000000
SELF-RENEWING (Y/N)? YY
CONTRACT DATE (MMDD) ? 11001122
LINEAGE TO DATE? 00
RATE PER LINE IN DOLLARS? ..5500
ANOTHER NEW ACCOUNT? NNOO
COMMAND ? LLIISSTT
RANGE OF ACCOUNT NUMBERS (R1,R2)? 1111,,1111
HOW MANY MONTHS UNTIL EXPIRATION? 00
DATE-   03/22/78


DATE-   03/22/78
ACCOUNT #   11
NAME      MR. PANEL
ADDRESS   CITYLINE PL.
CITY/STATE BAYONNE, N.J.
CONTRACT DATE        10/12
CONTRACT LINES       20000
RATE                 .5

TOTAL TO DATE        0
COMMAND ? AADDSS
ACCOUNT # (0 IF AT END OF LIST) ? 33

ACCOUNT NAME- HABAND
CORRECT ? YYEESS
DEPTH ? 5500
COLUMNS ? 22

LINES= 100
```

(Continued on following page)

Sample Run 2 continued

```
ACCOUNT # (0 IF AT END OF LIST) ? 44

ACCOUNT NAME- PAPER WORLD
CORRECT ? YYEESS
DEPTH ? 5555
COLUMNS ? 44

LINES= 220
ACCOUNT # (0 IF AT END OF LIST) ? 55

ACCOUNT NAME- RELIABLE FURNITURE
CORRECT ? YYEESS
DEPTH ? 8800
COLUMNS ? 55

LINES= 400
ACCOUNT # (0 IF AT END OF LIST) ? 55

ACCOUNT NAME- RELIABLE FURNITURE
CORRECT ? YYEESS
DEPTH ? 9900
COLUMNS ? 55

LINES= 450
ACCOUNT # (0 IF AT END OF LIST) ? 66

ACCOUNT NAME- ROGERS CLOTHES
CORRECT ? VV
PLEASE USE 'YES' OR 'NO'.
CORRECT ? YYEESS
DEPTH ? 3355
COLUMNS ? 1100

LINES= 350
ACCOUNT # (0 IF AT END OF LIST) ? 00

NAME                    DEPTH     COLUMNS   INSERTIONS  TOTAL LINES   #
HABAND                   50          2          1          100         1
PAPER WORLD              55          4          1          220         2
RELIABLE FURNITURE       80          5          1          400         3
RELIABLE FURNITURE       90          5          1          450         4
ROGERS CLOTHES           35         10          1          350         5

COMMAND ? TTRRAANNSS

TRANSACTION #  1
NAME-     HABAND
ACCOUNT #  3
DEPTH-     50
COLUMNS-   2
TOTAL LINES- 100
?

TRANSACTION #  2
NAME-     PAPER WORLD
ACCOUNT #  4
DEPTH-     55
COLUMNS-   4
TOTAL LINES- 220
?

TRANSACTION #  3
NAME-     RELIABLE FURNITURE
ACCOUNT #  5
DEPTH-     80
COLUMNS-   5
TOTAL LINES- 400
?

TRANSACTION #  4
NAME-     RELIABLE FURNITURE
ACCOUNT #  5
DEPTH-     90
COLUMNS-   5
TOTAL LINES- 450
?

TRANSACTION #  5
NAME-     ROGERS CLOTHES
ACCOUNT #  6
DEPTH-     35
COLUMNS-   10
TOTAL LINES- 350
?

COMMAND ? UUPPDDAATTEE
COMMAND ? LLIISSTT
RANGE OF ACCOUNT NUMBERS (R1;R2)? 11,,1100
HOW MANY MONTHS UNTIL EXPIRATION? 00
DATE-   03/22/78

DATE-   03/22/78
ACCOUNT #   1
NAME      DYNAMIC DOMESTIC
ADDRESS   2828 KENNEDY BLVD.
CITY/STATE JERSEY CITY,N.J.
CONTRACT DATE       04/15
CONTRACT LINES       50000
RATE                  .49

TOTAL TO DATE         0


DATE-   03/22/78
ACCOUNT #   2
NAME      DAVIS TOYS
ADDRESS   32ND ST.
CITY/STATE UNION CITY, N.J.
CONTRACT DATE       06/21
CONTRACT LINES       2000
RATE                  .46

TOTAL TO DATE         0


DATE-   03/22/78
ACCOUNT #   3
NAME      HABAND
ADDRESS   265 N. 9TH
CITY/STATE PATTERSON, N.J.
CONTRACT DATE       04/01
CONTRACT LINES       12000
RATE                  .51

TOTAL TO DATE         500


DATE-   03/22/78
ACCOUNT #   4
NAME      PAPER WORLD
ADDRESS   113 ENTERPRISE
CITY/STATE SECAUCUS,N.J.
CONTRACT DATE       03/21
CONTRACT LINES       4000
RATE                  .53

TOTAL TO DATE         220


DATE-   03/22/78
ACCOUNT #   5
NAME      RELIABLE FURNITURE
ADDRESS   310 JACKSON AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE       05/30
CONTRACT LINES       4000
RATE                  .49

TOTAL TO DATE         970


DATE-   03/22/78
ACCOUNT #   6
NAME      ROGERS CLOTHES
ADDRESS   113 BROAD ST.
CITY/STATE ELIZABETH, N.J.
CONTRACT DATE       11/20
CONTRACT LINES       12000
RATE                  .51

TOTAL TO DATE         3350


DATE-   03/22/78
ACCOUNT #   7
NAME      SCHLESINGEER
ADDRESS   BERGENLINE AVE.
CITY/STATE W. NEW YORK, N.J.
CONTRACT DATE       10/01
CONTRACT LINES       150000
RATE                  .4

TOTAL TO DATE         1280


DATE-   03/22/78
ACCOUNT #   8
NAME      SINGER SEWING
ADDRESS   747 5TH AVE.
CITY/STATE N.Y.C., N.Y.
CONTRACT DATE       01/01
CONTRACT LINES       4000
RATE                  .51

TOTAL TO DATE         1000

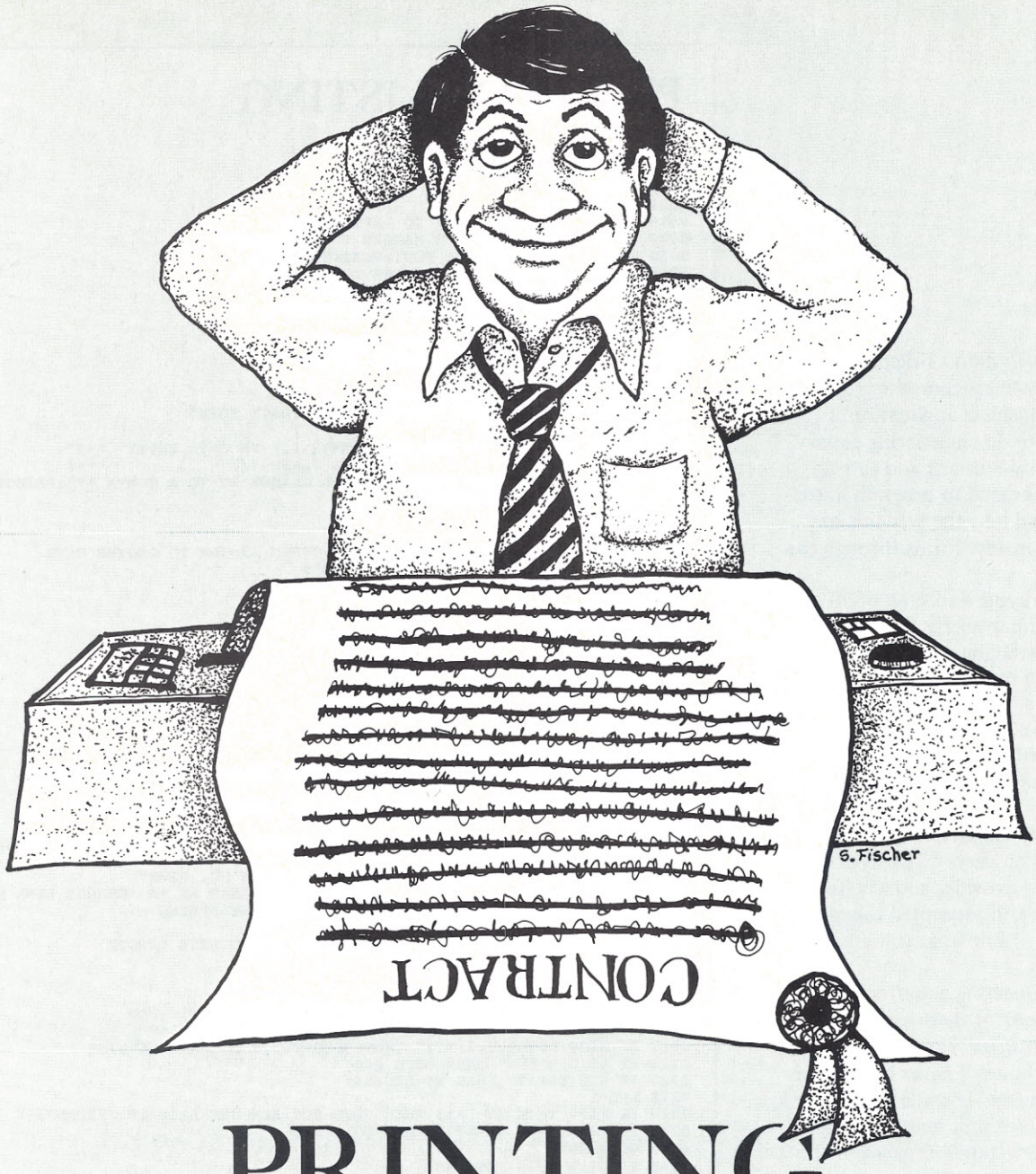

DATE-   03/22/78
ACCOUNT #   9
NAME      SYLVETTE GLADSTONE
ADDRESS   135 NEWARK AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE       03/30
CONTRACT LINES       200000
RATE                  .46

TOTAL TO DATE         0


DATE-   03/22/78
ACCOUNT #   10
NAME      BRAVERMAN
ADDRESS   770 WEST SIDE AVE.
CITY/STATE JERSEY CITY, N.J.
CONTRACT DATE       10/06
CONTRACT LINES       35000
RATE                  .49

TOTAL TO DATE         0
COMMAND ? EENNDD

OK
```



PRINTING CONTRACT FORMS

BY CHARLES A. MATZ

Our ADS Program (page 26) showed you how to use your computer to keep track of contract fulfillment. Now, you can program your micro to print the contract forms for you – and incidently answer that annoying question, "But what is a computer good for???"

Illustration by Stephen Fischer

I'll admit I didn't originally buy my microcomputer for a practical business application. I bought it to do engineering equations for my business and to play any game I cared to program in to it. I stepped into the business of printing contract forms through the back door . . .

After buying an SWTP 6800 computer, building an H9 Heathkit terminal, interfacing an IBM Selectric, and getting my system up and running with a Smoke Signal Broadcasting BFD-68 Dual Floppy Disk System, I faced the inevitable question from friends, "But what is it good for?"

Even my Newtech 68 Music Board, which plays "The Eyes of Texas" and provides sound effects for games, still prompted the same question – "But what is it good for?"

My engineering equations (who wants to look at them except for another engineer?) and programmed games (although I never heard questions from friends while they played Blackjack) weren't reason enough to justify the system's expense or the time I spent working on it.

Then one afternoon my wife asked to borrow my typewriter to type a contract form. She has an interior design firm and prefers typewritten contracts over preprinted forms or illegible handwritten ones. She uses several different contract forms daily and typed erasures or corrections are frowned upon by lawyers.

To relieve her of the tiresome

PROGRAM LISTING

```
0001 REM CONTRACT FORM PROGRAM
0010 REM HAPPY COMPUTING!!!!!!
0020 LINE= 100
0025 STRING= 60
0030 T1=7   :REM TAB EDGE TO LEFT MARGIN
0040 T2=28  :REM TAB LEFT MARGIN TO "CONTRACT"
0050 C=1    :REM CONTROL PORT=PORT#C=PORT#1
0060 PRINT #C,"WHAT PORT NUMBER FOR OUTPUT ";
0070 INPUT P7:REM OUTPUT PORT=PORT#P7
0090 DIM L$(13):REM USE L$(18) IF SYSTEM > 16K
0100 REM START OF PROGRAM
0104 P2=1:REM ADDITIONAL PAGE COUNTER
0105 N=1 :REM NUMBER OF INITIAL COPIES
0106 P1=1:REM PAGE NUMBER
0109 FOR J=1 TO 10:PRINT#C:NEXT J
0110 PRINT #C,"INTERIOR CONTRACTOR CONTRACT FORM"
0111 PRINT #C:PRINT#C
0112 PRINT #C,"***  DO NOT USE COMMAS (,) IN DATA ENTRY  ***"
0113 PRINT #C,"***        ENTER A SLASH (/)             ***"
0114 PRINT #C,"*** THE COMPUTER WILL CHANGE IT TO A COMMA **":PRINT#C
0115 PRINT #C,"ENTER DATE ";
0116 GOSUB 410
0117 D$=Y$
0118 T3=32-INT((LEN(D$)+5)/2):PRINT#C:REM T3=TAB TO CENTER DATE
0120 PRINT #C,"ENTER    CLIENTS NAME";
0125 GOSUB 410
0130 N$=Y$
0135 T0=LEN(N$)
0140 PRINT #C,"       STREET ADDRESS";
0145 GOSUB 410
0150 A$=Y$
0155 IF LEN(A$)>T0 THEN T0=LEN(A$)
0160 PRINT #C,"       CITY-STATE-ZIP";
0165 GOSUB 410
0170 C$=Y$
0175 IF LEN(C$)>T0 THEN T0=LEN(C$)
0177 T0=(T1+67)-T0:REM T0=TAB FOR CLIENT PRINTOUT TO RIGHT MARGIN
0178 PRINT #C
0180 PRINT #C,"ENTER JOB DESCRIPTION BY LINES (60 CHARS.MAX)"
0181 PRINT #C
0185 PRINT #C,"** TO CHANGE A PREVIOUS LINE TYPE (#)(LINE NO.)(BLANK)";
0186 PRINT #C,"(NEW LINE)"
0187 PRINT #C,"** EXAMPLE **  #5 CHANGE LINE NO. FIVE"
0188 PRINT #C,"**             MAKES LINE 5 READ AS **  CHANGE LINE NO. FIVE"
0190 L=1:PRINT#C:REM L=LINE COUNTER & L$=LINE STRING
0192 PRINT #C,TAB(12);"*";
0193 FOR J=1TO59:PRINT#C,"*";:NEXTJ:REM PRINT LINE LENGTH
0194 PRINT #C,TAB(72);"XXXXXX"
0200 REM INPUT L$ VALUES
0205 PRINT #C,"LINE #";L;"=";
0210 GOSUB 410:REM GET A LINE OF INPUT AND REMOVE / FOR
0215 L$(L)=Y$
0217 IF MID$(L$(L),1,1)="#" THEN GOTO 700:REM CHANGE A LINE
0220 IF L$(L)="END" THEN GOTO 240
0225 IF LEN(Y$)>T4 THEN T4=LEN(Y$)
0228 L=L+1
0230 IF P1>1 THEN IF L>13 THEN GOTO 300:REM USE L>18 IF SYSTEM>16K
0232 IF P1=1 THEN IF L>13 THEN GOTO 300
0235 GOTO 205
0240 IF P1>1 THEN GOTO 490
0245 PRINT #C,"ENTER TOTAL CONTRACT PRICE";
0250 INPUT #C,P
0260 PRINT #C,"      DEPOSIT WITH ORDER  ";
0270 INPUT #C,D
0275 T4=INT((67-T4)/2):REM T4=TAB TO CENTER BODY OF CONTRACT
0280 PRINT #C,"HOW MANY COPIES";
0285 INPUT #C,N
0286 N1=N:REM VALUE TO RECALL FOR NUMBER OF COPIES
0290 IF N>0 THEN GOTO 485
0295 GOTO 2370
0300 PRINT #C:PRINT#C,"WILL NEED ADDITIONAL PAGES LATER":P2=P1+1
0310 PRINT #C,CHR$(7),CHR$(7):GOTO 240
0400 REM LINE INPUT ROUTINE
0410 Y$="":INPUT#C,Z$
0430 J=1:REM SET UP LOOP
0435 REM REMOVE SLASH (/) FOR COMMA (,)
0440 IF MID$(Z$,J,1)="/" THEN Y$=Y$+","
0450 IF MID$(Z$,J,1)<>"/" THEN Y$=Y$+MID$(Z$,J,1)
0453 IF J=LEN(Z$) THEN GOTO 465
0454 REM CHECK FOR THIS LINE RE-ENTRY
0455 IF MID$(Z$,J,2)<>"##" THEN GOTO 465
0460 PRINT #C,"RE-ENTER ";:GOTO 410
0465 J=J+1:IF J<=LEN(Z$) THEN GOTO 440
0470 RETURN :REM RETURNS LINE AS Y$
0485 PRINT #P7,CHR$(12):REM FORM FEED
0490 PRINT #P7:PRINT#P7:PRINT#P7
0491 IF P1=1 THEN GOTO 495
0492 DIGITS= 0:PRINT#P7:PRINT#P7:PRINT#P7,TAB(T1+61);"PAGE ";P1
0493 FOR K=1 TO 7:PRINT#P7:NEXT K
0494 GOTO 605
0495 PRINT #P7,TAB(T1+T3);"DATE ";D$:PRINT#P7
0500 PRINT #P7,TAB(T1);"INTERIOR CONTRACTOR ";
0505 PRINT #P7,TAB(T0);"CLIENT"
0510 PRINT #P7,TAB(T1);"YOUR STREET HERE    ";
```

```
0515 PRINT #P7,TAB(T0);N$
0520 PRINT #P7,TAB(T1);"SUITE 123           ";
0525 PRINT #P7,TAB(T0);A$
0530 PRINT #P7,TAB(T1);"DALLAS, TEXAS  752XX";
0540 PRINT #P7,TAB(T0);C$:PRINT#P7
0550 PRINT #P7,TAB(T1+T2);"CONTRACT"
0555 PRINT #P7:PRINT#P7
0560 PRINT #P7,TAB(T1);"TO: INTERIOR CONTRACTOR"
0570 PRINT #P7,TAB(T1);"YOU ARE HEREBY AUTHORIZED TO ";
0580 PRINT #P7,"SECURE THE FABRICS AND OTHER NECESSARY"
0590 PRINT #P7,TAB(T1);"MATERIALS, MANUFACTURE, AND ";
0600 PRINT #P7,"INSTALL THE FOLLOWING:"
0605 PRINT #P7:PRINT#P7
0610 REM PRINT LINES FOR JOB DESCRIPTION
0615 IF T4>10 THEN T4=5:REM IF SHORT LINES, INDENT 5 BUT DON'T CENTER
0620 FOR J=1 TO L-1
0630 PRINT #P7,TAB(T1+T4);L$(J):PRINT#P7
0640 NEXT J
0650 GOTO 900
0700 REM ROUTINE TO CHANGE A PREVIOUS LINE
0710 J=1
0720 IF MID$(Y$,J,1)=" " THEN Z$=MID$(Y$,J+1,(LEN(Y$)-J)):GOTO 740
0730 J=J+1:IF J>LEN(Y$) THEN PRINT#C,"WHAT ???":GOTO 200
0735 GOTO 720
0740 PRINT #C,"LINE #";VAL(MID$(Y$,2,J-1));"=? ";Z$
0750 L$(VAL(MID$(Y$,2,J-1)))=Z$
0760 GOTO 200
0900 IF P1=1 THEN J=30:REM SKIP LINES
0905 IF P1>1 THEN J=40
0910 FOR T4=1 TO (J-(2*L)):PRINT#P7:NEXT T4
1000 DIGITS= 2
1010 IF P1=1 THEN GOTO 1100
1020 FOR J=1TO4:PRINT#P7:NEXT J:REM SKIP MORE LINES
1030 GOTO 2200
1100 PRINT #P7,TAB(T1);"TOTAL CONTRACT PRICE $ ";P
1130 PRINT #P7,TAB(T1);"DEPOSIT WITH ORDER   $ ";
1140 IF LEN(STR$(P))=LEN(STR$(D)) THEN GOTO 1155
1145 T4=LEN(STR$(P))-LEN(STR$(D))
1150 GOSUB 1210
1155 PRINT #P7,D
1160 PRINT #P7,TAB(T1);"DUE AT INSTALLATION  $ ";
1170 IF LEN(STR$(P))=LEN(STR$(P-D)) THEN GOTO 1185
1175 T4=LEN(STR$(P))-LEN(STR$(P-D))
1180 GOSUB 1210
1185 PRINT #P7,P-D:GOTO 2000
1200 REM SUBROUTINE TO RIGHT JUSTIFY
1210 FOR J=1 TO T4
1220 PRINT #P7," ";
1230 NEXT J
1240 RETURN
2000 PRINT #P7
2100 PRINT #P7,TAB(T1);"THE CUSTOMER HEREBY AGREES TO INSPECT";
2110 PRINT #P7," THE ABOVE WORK AT THE TIME OF"
2120 PRINT #P7,TAB(T1);"INSTALLATION AND MAKE ANY CLAIMS";
2130 PRINT #P7," FOR ADJUSTMENT WITHIN THIRTY DAYS"
2140 PRINT #P7,TAB(T1);"FROM THE DATE OF INSTALLATION.";
2150 PRINT #P7," THERE ARE NO VERBAL AGREEMENTS,"
2160 PRINT #P7,TAB(T1);"PROVISIONS, OR CONDITIONS OTHER";
2170 PRINT #P7," THAN THOSE EXPRESSED HEREIN."
2180 PRINT #P7:PRINT#P7
2200 PRINT #P7,TAB(T1+2);"_____";
2210 PRINT #P7,"                    _____"
2220 PRINT #P7,TAB(T1+2);" INTERIOR CONTRACTOR ";
2230 PRINT #P7,"                    CUSTOMER SIGNATURE "
2240 PRINT #P7
2250 PRINT #P7;TAB(T1);"*** THIS ORDER IS NOT SUBJECT TO";
2260 PRINT #P7," CANCELLATION AFTER THE INITIAL ***"
2270 PRINT #P7,TAB(T1);"****              PURCHASE OF FABRICS";
2280 PRINT #P7," OR MATERIALS               ****"
2284 REM FOR PRINTERS WITH FORM FEED, DELETE LINES 2284 THRU 2287
2285 FOR K=1 TO 4
2286 PRINT #P7
2287 NEXT K
2290 N=N-1:IF N>0 THEN GOTO 485
2300 P1=P1+1:N=N1:REM BUMP PAGE COUNTER & RESET NUMBER OF COPIES
2305 DIGITS= 0
2310 IF P2=P1 THEN PRINT#C,"PAGE ";P2:GOTO 190
2330 PRINT #C,"WANT ANOTHER CONTRACT (Y OR N)";:INPUT #C,A$
2350 IF MID$(A$,1,1)="Y" THEN GOTO 100
2370 PRINT #C,"THANK YOU":PRINT#C:PRINT#C:END
```

PROGRAM RUN

```
WHAT PORT NUMBER FOR OUTPUT ? 7

INTERIOR CONTRACTOR CONTRACT FORM


***  DO NOT USE COMMAS (,) IN DATA ENTRY  ***
***          ENTER A SLASH (/)            ***
*** THE COMPUTER WILL CHANGE IT TO A COMMA **

ENTER DATE ? MARCH 27/1978
```

typing chore, I wrote a computer program to allow editing, formatting and paging of the contract prior to printing. Computer-generated contracts are ideal from both the legal and practical (timesaving) standpoint.

In the process I also gained a convert – now if anyone asks "But what is it good for?", I just let my wife explain.

I don't use this program to make money; my wife uses it for her business. But you can, easily, turn it into a lemonade service for local businesses, contractors, builders, carpenters – anyone who does specialized work on contract. Charge a few dollars for each new contract you design, and a lesser amount for each contract you print. With a good printer, you can produce contracts on any kind of paper your customer desires – letterhead, carbon or carbonless sets, or special forms.

PROGRAM NOTES

The Contract Form program (see Program Listing) runs on Disk File BASIC for 6800 systems available from Computerware Software Services, Encinitas, CA. The only command used in this program which is not available on SWTPC 8K BASIC Version 2.0 is the STRING command. The command STRING= 60 on line 0025 of the program sets the length of all string variables to 60 characters maximum.

(Continued on following page)

Other commands used include the following:
DIGITS=n – Sets the number of digits printed to the right of the decimal point to (n).
LEN (X$) – Returns the number of characters in X$.
MID$ (X$, X, Y) – Returns a string of characters from X$ beginning with the Xth charcter from the left, and continuing Y characters from that point.
INT (X) – Returns the greatest integer less than X.
A$+B$ – Links A$ and B$ to form a new string variable.

Don't use commas (,) in the data entry; use a slash (/) and the computer will change it to a comma. If you need the slash symbol for text, change the (/) delimeter in lines 440 and 450 to some other delimeter.

If you make an error while entering a line, you can delete the line by typing "##". Note, though, that typing "##" anywhere in a line requires re-entry of the line.

If you wish to change a line previously entered, then at the start of a line type the # symbol, followed by the line number and a blank space; then continue with the corrected text for that line. (See Sample Run for example.)

To terminate text entry, type END as the first word of any line.

Your company name should be entered as text on line 500, your street address on line 510, your suite number on line 520, and your city-state-zip on line 530. You company name should again be entered as text on line 560 after the word TO; and also entered as text on line 2220. □

PROGRAM RUN continued

```
ENTER    CLIENTS NAME? PERSONAL COMPUTING
       STREET ADDRESS? 1050 COMMANWEALTH AVE.
       CITY-STATE-ZIP? BOSTON/MA. 02215

ENTER JOB DESCRIPTION BY LINES (60 CHARS.MAX)

** TO CHANGE A PREVIOUS LINE TYPE (#)(LINE NO.)(BLANK)(NEW LINE)
** EXAMPLE **  #5 CHANGE LINE NO. FIVE
**              MAKES LINE 5 READ AS **  CHANGE LINE NO. FIVE

          ************************************************************
LINE #1 =? THIS PROGRAM WAS WRITTEN TO PRINT OUT CONTRACT FORMS FOR
LINE #2 =? AN INTERIOR DESIGN FIRM. IF YOU WANT TO TYPE A COMMA IN
LINE #3 =? THE TEXT/ ENTER THE SLASH SYMBOL. TO DELETE THE LINE WHICH
LINE #4 =? IS CURRENTLY BEING ENTERED TYPE ##
RE-ENTER ? IS CURRENTLY BEING ENTERED TYPE TWO SUCCESSIVE # SYMBOLS
LINE #5 =? ANYWHERE IN THE LINE. GOOF-UP HERE
LINE #6 =? #5 ANYWHERE IN THE LINE. TO CORRECT A PREVIOUSLY ENTERED
LINE #5 =? ANYWHERE IN THE LINE. TO CORRECT A PREVIOUSLY ENTERED
LINE #6 =? LINE/ ENTER THE # SYMBOL AND OLD LINE NUMBER FOLLOWED BY A
LINE #7 =? SPACE AS THE FIRST CHARACTERS ON THE LINE.
LINE #8 =? YOU CAN ENTER 13 LINES ON THE FIRST PAGE/ AND 13 OR MORE
LINE #9 =? LINES ON SUCCEEDING PAGES DEPENDING ON THE SIZE OF MEMORY
LINE #10 =? AVAILABLE (SEE COMMENTS IN PROGRAM SOURCE LISTING).
LINE #11 =? TO END THE ENTRY TYPE END AS THE FIRST WORD OF A LINE.
LINE #12 =? END
ENTER TOTAL CONTRACT PRICE? 1000
      DEPOSIT WITH ORDER  ? 550
HOW MANY COPIES? 1



INTERIOR CONTRACTOR                          CLIENT
YOUR STREET HERE                             PERSONAL COMPUTING
SUITE 123                                    1050 COMMANWEALTH AVE.
DALLAS, TEXAS  752XX                         BOSTON,MA. 02215

                          CONTRACT

TO: INTERIOR CONTRACTOR
YOU ARE HEREBY AUTHORIZED TO SECURE THE FABRICS AND OTHER NECESSARY
MATERIALS, MANUFACTURE, AND INSTALL THE FOLLOWING:

    THIS PROGRAM WAS WRITTEN TO PRINT OUT CONTRACT FORMS FOR

    AN INTERIOR DESIGN FIRM. IF YOU WANT TO TYPE A COMMA IN

    THE TEXT, ENTER THE SLASH SYMBOL. TO DELETE THE LINE WHICH

    IS CURRENTLY BEING ENTERED TYPE TWO SUCCESSIVE # SYMBOLS

    ANYWHERE IN THE LINE. TO CORRECT A PREVIOUSLY ENTERED

    LINE, ENTER THE # SYMBOL AND OLD LINE NUMBER FOLLOWED BY A

    SPACE AS THE FIRST CHARACTERS ON THE LINE.

    YOU CAN ENTER 13 LINES ON THE FIRST PAGE, AND 13 OR MORE

    LINES ON SUCCEEDING PAGES DEPENDING ON THE SIZE OF MEMORY

    AVAILABLE (SEE COMMENTS IN PROGRAM SOURCE LISTING).

    TO END THE ENTRY TYPE END AS THE FIRST WORD OF A LINE.


TOTAL CONTRACT PRICE $ 1000.00
DEPOSIT WITH ORDER   $  550.00
DUE AT INSTALLATION  $  450.00

THE CUSTOMER HEREBY AGREES TO INSPECT THE ABOVE WORK AT THE TIME OF
INSTALLATION AND MAKE ANY CLAIMS FOR ADJUSTMENT WITHIN THIRTY DAYS
FROM THE DATE OF INSTALLATION. THERE ARE NO VERBAL AGREEMENTS,
PROVISIONS, OR CONDITIONS OTHER THAN THOSE EXPRESSED HEREIN.


_____                              _____
INTERIOR CONTRACTOR                CUSTOMER SIGNATURE

*** THIS ORDER IS NOT SUBJECT TO CANCELLATION AFTER THE INITIAL ***
****              PURCHASE OF FABRICS OR MATERIALS              ****


WANT ANOTHER CONTRACT (Y OR N)? N
THANK YOU
```

How to Write for Personal Computing

Have you programmed your computer to converse in Gaelic? to do your home-ec homework? to read a bedtime story to the kids? Are you a frustrated fiction writer who's caught the computer bug? Or, have you found the ideal system or the absolutely worst combination of components?

Why not share your experiences with our readers? Yes, you too can write for *Personal Computing.* You choose the topic, *any* topic. If your topic relates to computers, great. If it relates to personal computers, even better. Computer hobbyists are looking for an excuse, any excuse, to buy a computer, and you might just offer the justification they're looking for.

We accept articles for all our sections – *Launching Pad* (our tutorial section for beginners), *On the Lighter Side* (where we print humorous applications), *In the Money* (how to use your computer to benefit financially), *Digging In* (for our more "advanced" topics), and *Once Upon a Time* (where we let your imagination run wild). We'd love to see some comparisons of computers or computer products. Tell us the good *and* bad of your system.

Keep your writing simple. No, our readers are not simpletons or beginners, but if you can explain something in simple words, do so. Don't clutter your piece with unnecessary jargon. If you're already into computers, give the newcomers a hand and let them in on some of the tricks of the trade – in simple terms. Examples, analogies, and charts and diagrams help both the beginner and the more advanced user appreciate what you're saying. Feel free to use "I" and "you" to make your article more personal and meaningful to the reader. Put the reader in the position of programmer ("you"). Also, please do not write your entire article in caps. And please indent for each paragraph.

Some things to note. Make sure your details are accurate – especially prices, other numerical information, and company names. Don't rely on hearsay or memory.

If you write about a program you've invented, try this order (to make sure you cover all angles): state the program's purpose; show a sample run; explain what the input options are, and what the output means; show another sample run; explain the underlying theory (if any); state the language, version, and computer you used and their peculiarities; show the listing; explain the program's over-all structure; analyze the program's details line by line; and suggest how the reader might improve or change the program.

Whatever your area of interest, you can turn it into an article. For example, if you're interested in watching birds then why not try an article on how to use a computer to track bird migrations? Or if your business is _____, why not try a piece on computers and how they can be used to _____ _____. We're open to ideas

If you've never written for a publication before and you'd like to discuss your piece with us before beginning it, give us a call. (Please do *not* mail us vague story proposals or outlines. We'd rather see the first few paragraphs of your article.) We'd be glad to discuss what you have in mind, and offer a few ideas of our own

As a matter of form, we prefer (and are more likely to accept) articles that have been typed. Most of our articles run around 2-4 magazine pages. (There's about 3-3/4 typewritten pages to a magazine page.)

Now here's the good part: we pay for any original material we print, although the price varies depending on the *quality* of the article. (So make it good!)

Why not give it a whirl? There may be a latent Hemingway, Fitzgerald or Asimov beneath that Einsteinian exterior.

Factor Game

BY HERBERT L. DERSHEM

With this educational game you can sharpen your skills in factoring integers and develop analytical problem solving ability. The game, Factor, is designed for anyone with seventh grade math level ability. But bright youngsters should be able to play the game without too much difficulty.

The game was first described by J.B. Harkin and D.S. Martin in the November 1973 issue of *The Arithmetic Teacher*. This version of Factor adds to the flexibility of the original and can be implemented on a microcomputer system.

Program Run 1 shows a sample game. The underlined portions are typed by the user, who plays against the computer.

The computer first asks for the name of its opponent and then lets him choose the size of the array of numbers. Any size from 2 to 81 will be accepted, although arrays smaller than 10 don't make for very exciting games.

The user has the option of choosing first or letting the computer choose first. Only the very naive or the very confident will let the computer choose first, since the first player has an advantage. However, the larger the array, the smaller the advantage.

The computer then prints the array, which consists of all integers from 2 to the limit entered by the user, and invites the user to make a choice. The player making the choice can pick any number remaining in the array – call it N. He then received N points. The opponent scores by claiming all factors of N remaining in the array for which he receives the sum of all of these factors.

Picking the largest prime first is usually a good choice since the opponent can then claim no points. In the case of the sample shown in Sample Run 1,

Sharpen your factoring skills by pitting yourself against your computer.

Herb chose 13; the computer could claim nothing since 13 is prime.

After each round of choosing and claiming, the computer reports the score and prints the array with all chosen and claimed numbers omitted.

When it's the user's turn to claim factors, the factors must be entered one at a time with a zero entered when no more factors are known. If the user misses any possible claims, the computer reports them after the user completes his turn.

Also, if the user tries to claim an illegal number, the computer will report why the move is illegal and add, "You lose your turn."

When all numbers have been removed from the array, the computer reports the final score and asks the user if he would like the opportunity to play again. If the user decides not to play anymore, the computer reports the number of games won by each player and stops.

Sample Run 2 shows a listing of another game and illustrates the computer's reaction to erroneous input.

The computer determines its choices in a simple but thorough way. It sums the remaining claimable factors of each of the numbers still in the array. The computer's move is that choice which maximizes the difference between the number and the sum of its claimable factors. A dimensioned variable, A, stores the sum of the claimable factors of each number. Thus the computer's choice is determined by finding the largest remaining I - A (I).

Program Listing 1 shows Factor as implemented on the DEC system 10 computer system. (Program Notes refer to this listing.)

Program Listing 2 shows Factor as written for Radio Shack TRS-80 Level I BASIC. It's actually a more convenient program to run, since the array remains on the screen and does not need to be rewritten each time. This feature uses the PRINT AT command. The program as listed makes use of abbreviations in Level I BASIC and omits remarks to conserve storage.

One modification in the TRS-80 version is that A (I) is set negative if the integer I has been removed from the array. This feature is necessary since the subscripted string used to test an integer's presence in the DEC system 10 version is not available on the TRS-80.

The TRS-80 program runs in 4K of RAM.

Ambitious factorers can easily expand this program to work beyond the limit of 81. Also, if you have a slow terminal, you will probably want to modify the DEC system 10 version so that it doesn't print the array each time. This modification puts the heavy burden of bookkeeping on you, but you may find it preferable to long waits for output.

If you find the computer is too good for you, you can tone down its game by replacing the choice of strategy by some random form of selection. If, on the other hand, you want a stiffer challenge from the computer, its game could be improved by implementing a look-ahead strategy for choice selection.

Happy factoring! □

Program Listing 1

Decsystem 10 version of FACTOR

```
00010 REM*** FACTOR BY HERB DERSHEM.
00020 REM*** INSTRUCTIONS FOR PLAYING ARE IN THE FOLLOWING
00030 REM*** PRINT STATEMENTS.
00040 PRINT "THIS IS THE GAME OF FACTOR. YOU PLAY AGAINST"
00050 PRINT "THE COMPUTER. WHEN IT IS YOUR TURN, YOU CHOOSE"
00060 PRINT "A NUMBER FROM THE ARRAY OF NUMBERS DISPLAYED."
00070 PRINT "AFTER YOU HAVE CHOSEN A NUMBER, I CAN THEN CLAIM"
00080 PRINT "ALL NUMBERS REMAINING IN THE ARRAY WHICH ARE"
00090 PRINT "FACTORS OF YOUR CHOICE. FOR EXAMPLE, IF YOU"
00100 PRINT "CHOOSE 18, I CAN CLAIM 2,3,6, AND 9 IF THEY"
00110 PRINT "ARE STILL IN THE ARRAY. YOU WOULD RECEIVE 18"
00120 PRINT "POINTS AND I WOULD RECEIVE 20. THEN IT WOULD"
00130 PRINT "BE MY TURN TO CHOOSE AFTER WHICH YOU CLAIM FACTORS."
00140 PRINT "LET'S PLAY FACTOR!"
00150 DIM A(81),N$(81)
00160 REM*** VARIABLES USED THROUGHOUT THE PROGRAM:
00170 REM***     A$              PLAYER'S NAME
00180 REM***     A(I)        SUM OF FACTORS OF I REMAINING
00190 REM***     N$(I)     TWO CHARACTER STRING ELEMENT FOR
00200 REM***               PRINTING. IT IS I IF I IS IN THE
00210 REM***               ARRAY AND BLANK OTHERWISE.
00220 REM***     A           PLAYER'S SCORE
00230 REM***     B           COMPUTER'S SCORE
00240 REM***     W           NUMBER OF COMPUTER WINS
00250 REM***     Z           NUMBER OF PLAYER WINS
00260 PRINT
00270 W=0
00280 Z=0
00290 PRINT "WHAT IS YOUR NAME";
```

(Continued on following page)

Program Notes

Statement numbers	Purpose
10-260	Introductory remarks and instructions for playing.
270-600	Initialization of variables and arrays.
650-1170	Computer's move.
650-740	Find the best choice.
750-800	Record choice.
810-950	Accept and validate any claims.
960-1010	Record claims.
1020-1100	Test for and notify of unclaimed factors.
1110-1150	Test for end of game.
1160-1170	Print board.
1180-1570	Player's move.
1180-1280	Accept and validate choice.
1290-1350	Record choice.
1360-1510	Find, print and record all claims.
1520-1530	Print board.
1540-1570	Test for end of game.
1580-1760	Print the final score and offer another game.
2000-2090	Subroutine to print the board.

Sample Run II

(User responses are underlined)

```
WHAT IS YOUR NAME ?HERB
HOW LARGE DO YOU WANT THE ARRAY (MAX 81) ?15
DO YOU WANT TO CHOOSE FIRST (1=YES,0=NO) ?1


HERB'S SCORE  0          COMPUTER'S SCORE  0
 2   3   4   5   6   7   8   9  10
11  12  13  14  15

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?13
I CLAIM  NOTHING.

HERB'S SCORE  13          COMPUTER'S SCORE  0
 2   3   4   5   6   7   8   9  10
11  12      14  15

MY TURN. I CHOOSE  11
WHAT FACTOR OF 11  DO YOU CLAIM (0=NONE) ?0

HERB'S SCORE  13          COMPUTER'S SCORE  11
 2   3   4   5   6   7   8   9  10
    12      14  15

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?15
I CLAIM  3  5
HERB'S SCORE  28          COMPUTER'S SCORE  19
 2       4       6   7   8   9  10
    12      14
MY TURN. I CHOOSE 9
WHAT FACTOR OF  9  DO YOU CLAIM (0=NONE) ?0

HERB'S SCORE  28          COMPUTER'S SCORE  28
 2       4       6   7   8      10
    12      14

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?14
I CLAIM  2  7
```

(Continued on following page)

```
C0300 INPUT A$
C0310 PRINT "HOW LARGE DO YOU WANT THE ARRAY (MAX 81)";
C0320 INPUT N
C0330 IF N>81 THEN 360
C0340 IF N<2 THEN 360
C0350 IF N=INT(N) THEN 380
C0360 PRINT "ILLEGAL VALUE ENTERED. PLEASE TRY AGAIN."
C0370 GOTO 310
C0380 PRINT "DO YOU WANT TO CHOOSE FIRST (1=YES,0=NO)";
C0390 INPUT C
C0400 IF (C-1)*C =0 THEN 440
C0410 PRINT "PLEASE ENTER 1 OR 0."
C0420 GOTO 380
C0430 REM*** INITIALIZE A,B,A(),N$()
C0440 A=0
C0450 B=0
C0460 PRINT
C0470 MAT A=ZER
C0480 FOR I=2 TO N
C0490   N$(I)=STR$(I)
C0500   IF I>9 THEN 520
C0510   N$(I)=" "+N$(I)
C0520 NEXT I
C0530 REM*** SUBROUTINE 2000 PRINTS THE ARRAY.
C0540 GOSUB 2000
C0550 REM*** SET EACH A(J)= SUM OF FACTORS OF J
C0560 FOR I=2 TO N/2
C0570   FOR J=2*I TO N STEP I
C0580     A(J)=A(J)+I
C0590   NEXT J
C0600 NEXT I
C0610 REM*** IF PLAYER MOVED FIRST, WE BRANCH HERE.
C0620 IF C=1 THEN 1190
C0630 REM*** COMPUTER'S MOVE - FIND THE REMAINING VALUE L
C0640 REM***  WHICH GIVES THE GREATEST PROFIT AFTER CLAIMS.
C0650 M=1000000
C0660 L=0
C0670 FOR I=2 TO N
C0680   IF A(I)-I>M THEN 720
C0690   IF N$(I)="  " THEN 720
C0700   M=A(I)-I
C0710   L=I
C0720 NEXT I
C0730 REM*** IF L=0 THEN NO CHOICES LEFT.
C0740 IF L=0 THEN 1590
C0750 PRINT "MY TURN. I CHOOSE ";L
C0760 B=B+L
C0770 FOR I=2*L TO N STEP L
C0780   A(I)=A(I)-L
C0790 NEXT I
C0800 N$(L)="  "
C0810 PRINT "WHAT FACTOR OF ";L;" DO YOU CLAIM (0=NONE)";
C0820 REM*** ACCEPT CLAIM AND CHECK FOR VALIDITY.
C0830 INPUT D
C0840 IF D=0 THEN 1030
C0850 IF D<>INT(D) THEN 870
C0860 IF (D-1)*(D-N-1)<0 THEN 890
C0870 PRINT "CHOICE OUT OF RANGE. YOU LOSE YOUR TURN."
C0880 GOTO 1030
C0890 IF N$(D)<>"  " THEN 920
C0900 PRINT D;" IS NOT AVAILABLE. YOU LOSE YOUR TURN."
C0910 GOTO 1030
C0920 IF INT(L/D)*D=L THEN 960
C0930 PRINT D;" IS NOT A FACTOR OF ";L;". YOU LOSE YOUR TURN."
```

```
HERB'S SCORE  42          COMPUTER'S SCORE  37
      4       6       8       10
   12
MY TURN. I CHOOSE  10
WHAT FACTOR OF  10 DO YOU CLAIM (0=NONE) ?0

HERB'S SCORE  42          COMPUTER'S SCORE  47
      4       6       8
   12

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?4
I CLAIM  NOTHING.

HERB'S SCORE  46          COMPUTER'S SCORE  47
              6       8
   12
MY TURN. I CHOOSE  8
WHAT FACTOR OF  8  DO YOU CLAIM (0=NONE) ?0

HERB'S SCORE  46          COMPUTER'S SCORE  55
              6
   12
```

```
YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?12
I CLAIM  6
HERB'S SCORE  58          COMPUTER'S SCORE  61


FINAL SCORE - HERB  58      COMPUTER 61
I WON THAT TIME, BUT YOU CAN HAVE ANOTHER CHANCE.
WANT TO PLAY AGAIN (1=YES,0=NO) ?0
I WON  1 GAMES AND YOU WON  0
```

Sample Run 2
(User responses are underlined)

```
WHAT IS YOUR NAME ?HERB
HOW LARGE DO YOU WANT THE ARRAY ?36
DO YOU WANT TO CHOOSE FIRST (1=YES,0=NO) ?0
HERB'S SCORE  0          COMPUTER'S SCORE  0
 2   3   4   5   6   7   8   9  10
```

```
C0940 GOTO 1030
C0950 REM*** UPDATE A(I) FOR CHOICE D.
C0960 FOR I=2*D TO N STEP D
C0970   A(I)=A(I)-D
C0980 NEXT I
C0990 N$(D)="  "
01000 A=A+D
01010 GOTO 810
01020 REM*** TEST IF ALL FACTORS CLAIMED.
01030 IF A(L)<=0 THEN 1100
01040 PRINT "YOU COULD ALSO HAVE CHOSEN ";
01050 FOR I=2 TO L/2
01060   IF N$(I)="  " THEN 1090
01070   IF INT(L/I)*I<>L THEN 1090
01080   PRINT I;" ";
01090 NEXT I
01100 N$(L)="  "
01110 REM*** TEST FOR GAME OVER
01120 FOR I=2 TO N
01130   IF N$(I)<>"  " THEN 1170
01140 NEXT I
01150 GOTO 1590
01160 REM*** PRINT ARRAY.
01170 GOSUB 2000
01180 REM*** NOW IT'S PLAYER'S TURN.
01190 PRINT
01200 PRINT "YOUR TURN. WHAT NUMBER DO YOU CHOOSE";
01210 INPUT C
01220 REM*** TEST FOR VALID CHOICE.
01230 IF (C-1)*(C-N-1)<0 THEN 1260
01240 PRINT "CHOICE OUT OF RANGE. CHOOSE AGAIN."
01250 GOTO 1200
01260 IF N$(C)<>"  " THEN 1300
01270 PRINT C;" IS NOT AVAILABLE. CHOOSE AGAIN."
01280 GOTO 1200
01290 REM*** UPDATE A(I) FOR THIS CHOICE C.
01300 FOR I=2*C TO N STEP C
01310   A(I)=A(I)-C
01320 NEXT I
01330 A=A+C
01340 N$(C)="  "
01350 L=C
01360 PRINT "I CLAIM ";
01370 REM*** ARE THERE ANY CLAIMS?
01380 IF A(C)>0 THEN 1420
01390 PRINT " NOTHING."
01400 GOTO 1530
01410 REM*** FIND AND PRINT ALL CLAIMS.
01420 FOR I=2 TO L/2
01430   IF N$(I)="  " THEN 1510
01440   IF INT(L/I)*I<>L THEN 1510
01450   PRINT I;
01460   FOR J=2*I TO N STEP I
01470     A(J)=A(J)-I
01480   NEXT J
01490   B=B+I
01500   N$(I)="  "
01510 NEXT I
01520 REM*** PRINT THE ARRAY.
01530 GOSUB 2000
01540 REM*** TEST FOR GAME OVER.
01550 FOR I=2 TO N
01560   IF N$(I)<>"  " THEN 650
01570 NEXT I
```

(Continued on following page)

```
 11  12  13  14  15  16  17  18  19
 20  21  22  23  24  25  26  27
MY TURN. I CHOOSE  23
WHAT FACTOR OF 23 DO YOU CLAIM (0=NONE) ?11
 11  IS NOT A FACTOR OF  23 . YOU LOSE YOUR TURN.

HERB'S SCORE  0          COMPUTER'S SCORE  23
 2   3   4   5   6   7   8   9  10
11  12  13  14  15  16  17  18  19
20  21  22      24  25  26  27

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?25
I CLAIM  5
HERB'S SCORE  25          COMPUTER'S SCORE  28
 2   3   4       6   7   8   9  10
11  12  13  14  15  16  17  18  19
20  21  22      24      26  27
MY TURN. I CHOOSE  19
WHAT FACTOR OF  19  DO YOU CHOOSE (0=NONE) ?0

HERB'S SCORE  25          COMPUTER'S SCORE  47
 2   3   4       6   7   8   9  10
11  12  13  14  15  16      18
20  21  22      24      26  27

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?23
 23  IS NOT AVAILABL   CHOOSE AGAIN.
YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?27
I CLAIM  3  9
HERB'S SCORE  52          COMPUTER'S SCORE  59
 2       4       6   7   8      10
11  12  13  14  15  16  17  18
20  21  22      24      26

MY TURN. I CHOOSE  17
WHAT FACTOR OF  17  DO YOU CLAIM (0=NONE) ?0

HERB'S SCORE  52          COMPUTER'S SCORE  76
 2       4       6   7   8      10
11  12  13  14  15  16      18
20  21  22      24      26

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?18
I CLAIM  2  6
```

(Continued on following page)

```
01580 REM*** GAME'S OVER - PRINT RESULT.
01590 PRINT "FINAL SCORE - ",A$;" ";A,"COMPUTER ";B
01600 IF A>B THEN 1720
01610 IF A=B THEN 1750
01620 W=W+1
01630 PRINT "I WON THAT TIME, BUT YOU CAN HAVE ANOTHER CHANCE."
01640 PRINT "WANT TO PLAY AGAIN (1=YES,0=NO)";
01650 INPUT C
01660 IF C=1 THEN 310
01670 IF C=0 THEN 1700
01680 PRINT "PLEASE ENTER 1 OR 0."
01690 GOTO 1640
01700 PRINT "I WON ";W;" GAMES AND YOU WON ";Z
01710 STOP
01720 Z=Z+1
01730 PRINT "YOU WON, BUT YOU WERE LUCKY."
01740 GOTO 1640
01750 PRINT "TIE GAME."
01760 GOTO 1640
01990 REM*** PRINT ARRAY
02000 PRINT
02010 PRINT A$;"'S SCORE ";A;"      ";"COMPUTER'S SCORE ";B
02020 FOR I=2 TO N
02030 PRINT N$(I);"  ";
02040 IF INT((I-1)/9)*9<>I-1 THEN 2060
02050 PRINT
02060 NEXT I
02070 PRINT
02080 RETURN
02090 END
```

Program Listing 2

TRS-80 version of factor

```
40 P. "THIS IS THE GAME OF FACTOR. YOU PLAY AGAINST"
50 P. "THE COMPUTER. WHEN IT IS YOUR TURN, YOU CHOOSE"
60 P. "A NUMBER FROM THE ARRAY OF NUMBERS DISPLAYED."
70 P. "AFTER YOU HAVE CHOSEN A NUMBER, I CAN THEN CLAIM"
80 P. "ALL NUMBERS REMAINING IN THE ARRAY WHICH ARE"
90 P. "FACTORS OF YOUR CHOICE. FOR EXAMPLE, IF YOU"
100 P. "CHOOSE 18, I CAN CLAIM 2,3,6, AND 9 IF THEY"
110 P. "ARE STILL IN THE ARRAY. YOU WOULD RECEIVE 18"
120 P. "POINTS AND I WOULD RECEIVE 20. THEN IT WOULD"
130 P. "BE MY TURN TO CHOOSE AFTER WHICH YOU CLAIM FACTORS."
140 P. "LET'S PLAY FACTOR!"
260 P.:W=0:Z=0
290 P. "WHAT IS YOUR NAME";:IN. A$
310 P. "HOW LARGE DO YOU WANT THE ARRAY (MAX. 81)";:IN. N
330 IF (N>1)*(N<82)*(N=INT(N)) THEN 380
340 P. "ILLEGAL VALUE ENTERED. PLEASE TRY AGAIN.":G. 310
380 P. "DO YOU WANT TO CHOOSE FIRST (1=YES,0=NO)";:IN. C
400 IF (C=1)+(C=0) THEN 440
410 P. "PLEASE ENTER 1 OR 0":G. 380
440 A=0:B=0:CLS
450 P. AT 0,A$;"'S SCORE ";A;
460 P. AT 32,"TRS-80'S SCORE ";B
470 F. I=2 TO N:A(I)=0:P. AT 48+8*I,I;N. I
560 P. I=2 TO N/2:F J=2*I TO N STEP I:A(J)=A(J)+I:N. J:N. I
620 IF C=1 THEN 1170
650 M=1000000:L=0:F. I=2 TO N
680 IF (A(I)-I>M)+(A(I)<0) THEN 720
700 M=A(I)-I:L=I
720 N. I
```

```
HERB'S SCORE  70          COMPUTER'S SCORE  84
        4           7   8       10
11  12  13  14  15  16
20  21  22      24      26
MY TURN. I CHOOSE  15
WHAT FACTOR OF  15  DO YOU CLAIM (0=NONE) ?0

HERB'S SCORE  70          COMPUTER'S SCORE  99
        4           7   8       10
11  12  13  14      16
20  21  22      24      26

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?26
I CLAIM  13
HERB'S SCORE  96          COMPUTER'S SCORE  112
        4           7   8       10
11  12      14      16
20  21  22      24
MY TURN. I CHOOSE  21
WHAT FACTOR OF  21  DO YOU CLAIM (0=NONE) ?0

YOU COULD ALSO HAVE CHOSEN  7
HERB'S SCORE  96          COMPUTER'S SCORE  133
        4           7   8       10
11  12      14      16
20      22      24

YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?22
I CLAIM  11
HERB'S SCORE  118         COMPUTER'S SCORE  144
        4           7   8       10
    12      14      16
20              24
MY TURN. I CHOOSE  10
WHAT FACTOR OF  10  DO YOU CLAIM (0=NONE) ?0

HERB'S SCORE  118         COMPUTER'S SCORE  154
        4           7   8
    12      14      16
20              24
```

```
740 IF L=0 THEN 1590
750 P. AT 704,"MY TURN. I CHOOSE ";L
760 B=B+L:P. AT 32,"TRS-80'S SCORE ";B
770 IF 2*L>N THEN 800
780 F. I=2*L TO N STEP L:A(I)=A(I)-L:N. I
800 P. AT 48+8*L,"  ";
810 P. AT 832:P. AT 832,"WHAT FACTOR OF";L;"DO YOU CLAIM (0=NONE)";
830 IN. D:IF D=0 THEN 1030
850 IF (D>1)*(D<=N)*(D=INT(D)) THEN 890
870 P. AT 896,"CHOICE OUT OF RANGE.";
880 P. " YOU LOSE YOUR TURN.":F. I=1 TO 1500:N. I:G. 1030
890 IF A(D)>=0 THEN 920
900 P. AT 896,D;"IS NOT AVAILABLE.";:G. 880
920 IF INT(L/D)*D=L THEN 960
940 P. AT 896,D;"IS NOT A FACTOR OF";L;".";:G. 880
960 IF 2*D>N THEN 990
970 F. I=2*D TO N STEP D:A(I)=A(I)-D:N. I
990 A(D)=-100:P. AT 48+8*D,"  ";
1000 A=A+D:P. AT 0,A$;"'S SCORE ";A;
1010 G. 810
1030 IF A(L)=0 THEN 1100
1040 P. AT 896:P. AT 896,"YOU COULD ALSO HAVE CHOSEN ";
1050 F. I=2 TO L/2:IF (A(I)<0)+(INT(L/I)*I<>L) THEN 1090
1080 P. I;" ";
1090 N. I:F. I=1 TO 1500:N. I
1100 A(L)=-100
1120 F. I=2 TO N:IF A(I)>=0 THEN 1170
1140 N. I:G. 1590
1170 P. AT 768:P.:P.
1200 P. AT 704:P. AT 704,"YOUR TURN. WHAT NUMBER DO YOU CHOOSE";
1210 IN. C
1230 IF (C>1)*(C<=N)*(C=INT(C)) THEN 1260
1240 P. AT 769,"CHOICE OUT OF RANGE. CHOOSE AGAIN.":G. 1200
1260 IF A(C)>=0 THEN 1300
1270 P. AT 768,C;"IS NOT AVAILABLE. CHOOSE AGAIN.":G. 1200
1300 IF 2*C>N THEN 1320
1310 F. I=2*C TO N STEP C:A(I)=A(I)-C:N. I
1320 P. AT 768
1330 A=A+C:P. AT 0,A$;"'S SCORE ";A;
1340 P. AT 48+8*C,"  ";
1350 L=C:P. AT 832,"I CLAIM ";
1370 O=840
1380 IF A(C)>0 THEN 1420
1390 P. "NOTHING.":G. 1530
1420 F. I=2 TO L/2:IF (A(I)<0)+(INT(L/I)*I<>L) THEN 1510
1450 P. AT O,I;" ";:O=O+4:F. J=I TO N STEP I:A(J)=A(J)-I:N. J
1490 B=B+I:P. AT 32,"TRS-80'S SCORE ";B;:A(I)=-100
1500 P. AT 48+8*I,"  ";
1510 N. I
1530 A(C)=-100
1540 F. I=2 TO N:IF A(I)>=0 THEN 650
1570 N. I
1590 CLS:P. "FINAL SCORE - ";A$;" ";A,"TRS-80 ";B
1600 IF A>B THEN 1720
1610 IF A=B THEN 1750
1620 W=W+1:P. "I WON THAT TIME, BUT YOU CAN HAVE ANOTHER CHANCE."
1630 P. "WANT TO PLAY AGAIN (1=YES,0=NO)";:IN. C
1660 IF C=1 THEN 310
1670 IF C=0 THEN 1700
1680 P. "PLEASE ENTER 1 OR 0.":G. 1630
1700 P. "I WON ";W;" GAMES AND YOU WON ";Z
1710 STOP
1720 Z=Z+1
1730 P. "YOU WON, BUT YOU WERE LUCKY.":G. 1630
1750 P. "TIE GAME.":G. 1630
```

```
YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?20
I CLAIM  4
HERB'S SCORE  138          COMPUTER'S SCORE  158
                7   8
    12      14      16
              24
MY TURN. I CHOOSE  12
WHAT FACTOR OF 12 DO YOU CLAIM (0=NONE) ?6
 6  IS NOT AVAILABLE. YOU LOSE YOUR TURN.

HERB'S SCORE  138          COMPUTER'S SCORE  170
                7   8
          14      16
              24
YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?24
I CLAIM  8
HERB'S SCORE  162          COMPUTER'S SCORE  178
                7
          14      16
```

```
MY TURN. I CHOOSE  16

WHAT FACTOR OF  16  DO YOU CLAIM (0=NONE) ?0

HERB'S SCORE  162          COMPUTER'S SCORE  194
                  7
              14


YOUR TURN. WHAT NUMBER DO YOU CHOOSE ?14
I CLAIM  7
HERB'S SCORE  176          COMPUTER'S SCORE  201


FINAL SCORE - HERB  176     COMPUTER  201
I WON THAT TIME, BUT YOU CAN HAVE ANOTHER CHANCE.
WANT TO PLAY AGAIN (1=YES,0=NO) ?0
I WON  1  GAMES AND YOU WON  0
```

This economic report is brought to you by . . .

BY KAREN S. WOLFE

– June 30, 1991

Dan intensely studied the monitor of his 240K microcomputer system. He made his decision and input the next move. Confidently, he watched the computer maneuver to escape his challenge but his wife's gentle nudge interrupted the contest.

"Dan, it's time for the Socio-Economic Report. Do you still want to do it this quarter?" The inflection in Cheryl's voice was almost apologetic.

In the past, the mention of the Federal Computer Census had evoked a quarrel from her quiet husband. His political philosophies didn't blend with the required quarterly microscopic demographic review. Yet, for some still unexplained reason, Dan had volunteered to submit this quarter's report.

"Sure," he replied, "I'll do it." Then, he pointed to the computer's white flag. "Hey, look here, I won!"

"Well, it's about time," Cheryl shrugged. "You've been playing that old Star Wars game for 10 years."

"Come on," he pleaded, "I've got a pretty good record against the Empire. Besides, how many times have you won?"

"No comment." Then she turned to leave, saying, "Let me know when you're done with the computer. Brown's is having a sale and I'd like to do a little teleshopping."

Dan nodded while under his breath he whispered, "Computer, I wish I could program you to print money instead of just telling us how to spend it."

His attention moved to the Federal Computer Census manual. He fumbled through the simplified version until he stumbled across the proper telephone number on page 998, Appendix A. He dialed the number, placed the phone in the modem's cradle and effectively turned his micro system into a timesharing terminal.

The monitor let him know the proper connection had been established, "ON LINE WITH REGION IX'S DEMOGRAPHIC AND ECONOMIC CENSUS COMPUTER." The mere sight of those words on his monitor triggered something within Dan. He became an unreasoning mental terrorist.

The first prompt for input from the R-9 computer appeared on the screen, "HOUSEHOLD DESIGNATOR NUMBER?"

Dan entered the response, "9-363-221-747-933," taking particular care all the numbers were correct to insure no other household would be blamed for what he was about to do.

Dan set the census manual aside; he wouldn't need it. The software-wetware duel was about to begin.

The first set of questions appeared on the monitor, "TAXPAYER NUMBER, RACE, AGE, SEX OF HEAD-OF-HOUSEHOLD?"

With a sly vindictiveness he replied, "Why do you want to know?"

The screen cleared, there was a pause, then the census computer retorted, "THIS IS THE FEDERAL SOCIO-ECONOMIC CENSUS PROGRAM DESIGNED TO COLLECT AND TABULATE ACCURATE, CURRENT DATA WHICH IS NECESSARY FOR ECONOMIC AND SOCIAL PLANNING AS WELL AS THE DIRECT ALLOCATION OF FUNDING FOR VARIOUS SOCIAL PROGRAMS." The screen cleared and without hesitation R-9 sent an additional message, "IF YOU NEED ASSISTANCE WITH THE FIRST SET OF QUESTIONS, CONSULT PAGES 243-304 OF THE MANUAL."

Dan almost laughed out loud as he began feeding false information into the system. The machine consumed his inputs and responded with a second set of questions, "EMPLOYMENT STATUS, OCCUPATION AND MONTHLY INCOME OF HEAD-OF-HOUSEHOLD?"

Dan's entries were something less than accurate – "Occasionally employed, sludge slinger, $1.40."

The census program responded quickly, "THE MONTHLY INCOME OF $1.40 IS NOT REASONABLE AND DOES NOT MEET TOLERANCE STANDARDS. AT PRESENT, THE INPUT/OUTPUT UNITS OF THIS CENSUS COMPUTER ARE BEING USED TO THEIR MAXIMUM. IF YOU ARE HAVING DIFFICULTY FILING YOUR REPORT, PLEASE DISCONNECT AND TRY AGAIN LATER WHEN THE COMPUTER HAS TIME TO GIVE YOU INDIVIDUAL AID IN FILING. DO YOU WISH TO DISCONNECT?"

"No," Dan replied; he had not completed his mission. Then he re-entered an income figure that would

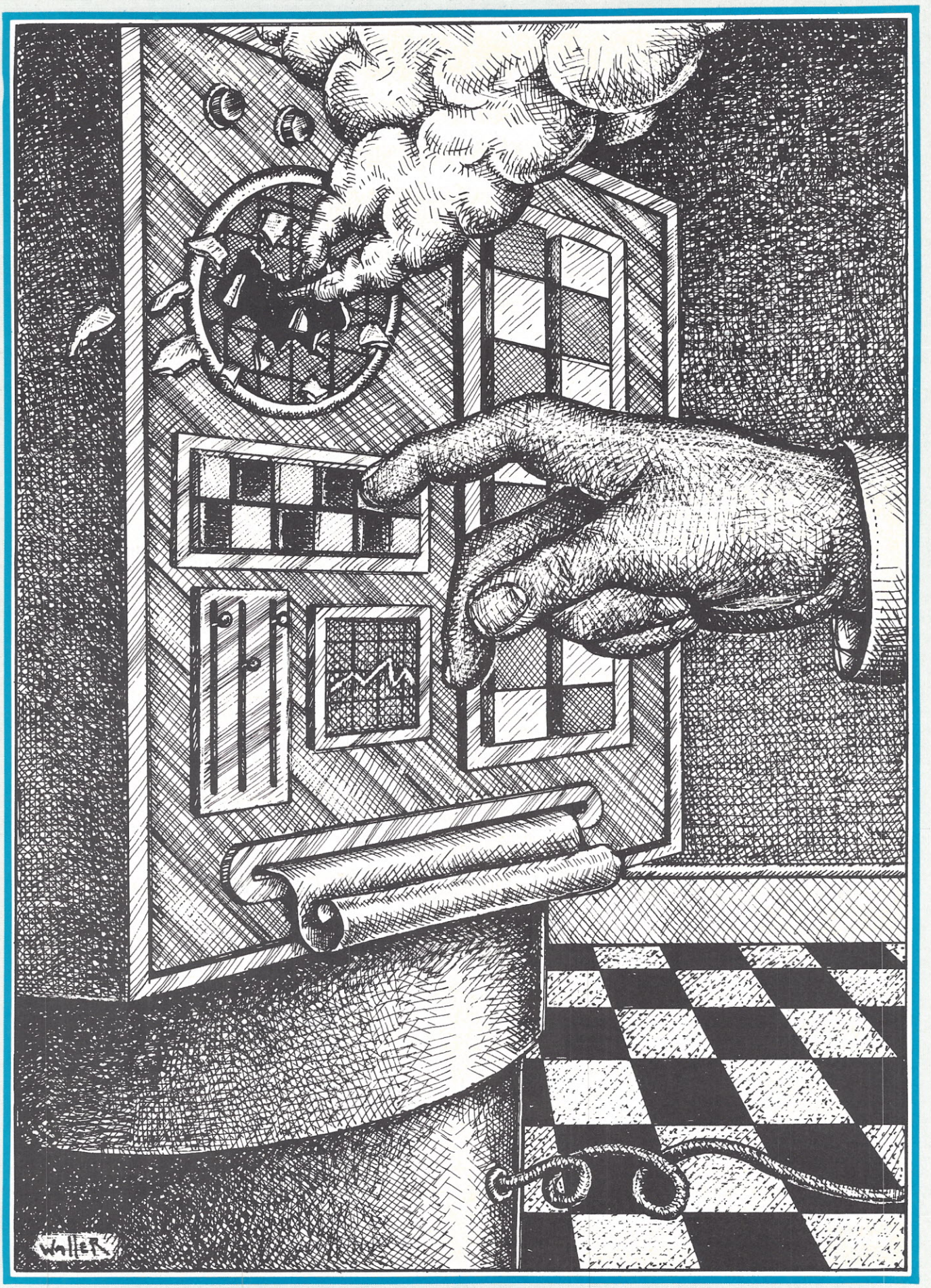


Illustration by Charles Waller

R-9 was about to cut him off. But, with his knowledge of the software, he fought for control.

meet tolerance standards but not the standard of truth. He knew the software program thoroughly but, then, he should. He had been one of its creators.

The "game" continued. A third, a fourth and a fifth set of inquiries flashed to the screen, "NUMBER IN HOUSEHOLD? – RACE, AGE, SEX, EMPLOYMENT STATUS FOR ALL OTHER FAMILY MEMBERS? – HEALTH STATUS? – OCCUPATIONS, INCOMES? – IS THE RELATIONSHIP BETWEEN THE MALE AND FEMALE HEADS-OF-HOUSEHOLD ONE OF MARITAL OR NON-MARITAL COHABITATION? – DO YOU PLAN TO CONCEIVE A CHILD NEXT MONTH? WHICH SEX? and on, and on..."

Dan continued to feed garbage to the monster and it voraciously devoured every piece, not detecting the poison it contained. But Dan's passion for retaliation wasn't satisfied. He wanted to strike a final blow.

He began by sending an endless string of nonsense over the wires. But R-9 was up to the challenge. It blocked his transmission and sent back a response of its own, "YOUR ENTRIES DO NOT MEET TOLERANCE STANDARDS. YOU ARE TYING UP NEEDED INPUT/OUTPUT CAPABILITIES . . . "

Dan realized R-9 was about to cut him off. But, with his knowledge of the software, he fought for control. By using a series of internal codes he managed to prevent being kicked off the system and he gained access to the guts of the program.

He asked R-9 to tell him how many terminals were filing reports at that moment. The answer was given, "999,873."

"That should be enough," Dan whispered. After making certain R-9 could not kill his transmission again, he returned to the external program.

The last set of questions appeared on the monitor. Dan had no intention of limiting his answers. Once again an endless stream of nonsense flowed toward R-9's input unit. Dan had a firm grip on the system now and was not about to back off.

Finally, the system's general override took control. Dan sat back in his chair and stretched as R-9's last message appeared. "SYSTEM OVERLOADED AND GOING DOWN. YOU HAVE FIVE SECONDS TO SAVE DATA." Then, the screen was blank.

With an air of mild surprise, Dan whispered, "It crashed, the system really crashed." A feeling of satisfaction and, perhaps, even sadness came over him. He knew, though, that R-9 would be up and pulsating in a few hours but at least he had won this battle.

Still and quiet he sat in front of the visually silent monitor, exhausted from his mental battle. Time became an unmeasured quantity. Echos as from the far end of a tunnel reached out to Dan's consciousness. Finally, he realized his home protection sensor was alerting him to someone approaching the front door. Wearily, he forced himself to the entrance.

He opened the door to find a short, plump young woman with skin that was too white, eyes that were too small and a mouth that was too firm, waiting for him. She carried a briefcase that seemed to pull her to one side causing a slight list.

She spoke first, "Mr. Adams, I am from the Quality Control Unit of the Census Bureau. I received a message from the regional office this afternoon that a disturbance was originating from your terminal. Perhaps you need guidance in filing your quarterly report?"

A renewed strength began to flow within Dan. A curious smile crossed his face. "Disturbance? Well, I was having a problem communicating with R-9 today. I think there must be a foul-up in the software somewhere. It should be checked." Dan casually waved his hand toward the briefcase, "Say, don't you have a complete printout on me in there? Don't you know who I am?"

Surprised by his question, the woman replied defensively, "Ah . . . well . . . we were lucky to get the household designator number, let alone your characteristics. The computer isn't functioning as efficiently as usual today."

Dan nodded, "I'd agree to that." He pulled his wallet out of his pocket and showed her his Federal ID card, the one with the title "Senior Economist for Region IX." The young woman took a quick step back and became very apologetic.

"I'm sorry," she said. "There must be a mistake. I mean, you wouldn't have . . . well . . . "

"Don't get upset. I realize you have to do what the computer tells you. I guess it just kicked out my name and household number," Dan said in a quiet tone.

His words seemed to soothe her and she forced a smile. "You know, I thought you looked familiar . . . and I've read many of your works on free market economic allocation." She continued to backpedal down the walk, "I'm so sorry to have bothered you, Mr. Adams. There must be a mistake in the printout."

Dan leaned against the door and nodded his head in agreement, "Yes, there must be a mistake . . . somewhere."

Another round of mental terrorism against invasion of privacy had ended, but it would not be the final battle. Dan knew the war between bureaucratic intrusion and individual freedom would continue. □

CIRCLE 11 ▶



The Computer for the Professional

The 8813 was built with you, the professional, in mind. It quickly and easily processes cost estimates, payrolls, accounts, inventory, patient/client records and much more. You can write reports, briefs, and proposals on the 8813's typewriter keyboard, see them on the video screen, and instantly correct, revise, or print them.

Using the 8813, one person can process what would normally require many secretaries, several bookkeepers, and a great deal of *time*. And data storage takes a small fraction of the *space* used by previous methods.

You don't need to learn complicated computer languages. The 8813 understands commands in English. If you want to write your own programs, the 8813 includes a simple computer language, BASIC, that you can master in a few days. The 8813 slashes the professional's overhead. It's a powerful time and money-saving ally. Prices for complete systems including printer start at less than $8,000.

See the 8813 at your local dealer or contact PolyMorphic Systems, 460 Ward Drive, Santa Barbara, California, 93111, (805) 967-0468, for the name of the dealer nearest you.

PolyMorphic Systems



PARTNER MATCHING

BY HARRIET MORRILL

People Matching" services can be used for a number of applications. You can pair tennis or bridge partners according to skill for a local tournament, match roomates, or pair up people looking for rides with those looking for riders.

This "People Matching" program can be used just for fun, or, with some ingenuity, you might be able to market your services. Contact a local tennis club, YMCA basketball league or any community or business organization who might be interested in your people matching service.

To custom design a program for a group, you only need to write a new questionnaire. Input the results and your work is done.

A note of caution: if you plan to use the program for a venture into computer dating, be careful that your Cupid's arrow doesn't end up stabbing someone in the heart . . .

Your Output

Originally designed to match couples for a dance at the Hotchkiss School in Lakeville, CT, the "People Matcher" announces its results in a rather unusual way — if the tape option is selected, the names of each paired couple are punched out, in human readable form, on paper tape.

For on-site matching, the pairings can be torn off the machine with all the excitement of news "hot off the wire". Or, if your matching centers around a party, you can keep the continuous ribbon for later use as decoration for the event, as they did at the school for their dance last spring.

People Matcher produced 139 couples for the Hotchkiss school dance, working with an input of an equal number of girls and boys. (For days after the Computer Club taped up the 250 ft. list of names, traffic moved



Illustration by Doug Smith
Photograph by Jon Buchbinder

Chess opponent, dinner guest – How to pair the partners best? Dancing, tennis, baseball, whist, Let your micro pair the list!

Program Notes for the People Matcher

These notes apply to the "People Matcher" as used in the Hotchkiss School dance-date matching. When it is not mandatory that the number of men and women be equal, you can adjust the program accordingly.

Setting the Dimensions. Change the subscripts in line 6 to match the number of pairs and questions you will have:

S%	(number of females, number of males)
F$	(number of females)
M$	(number of males)
F%	(number of females, number of questions)
M%	(number of males, number of questions)

The number of females and number of males must be equal. The number of questions includes two concerning the weight percents for material things and for human relationships.

Entering Data. The names and the replies must be typed in and stored in the same order. Thus, if a girl's name is seventh in the list of names her replies must be seventh in the list of replies. The name addressed by F$ (7) must corespond to the response addressed by F$ (7, question number).

Data storage limitations. The number of pairs and the amount of responses the program will handle will be determined by the size of the memory available when the program is run. On a 16-bit PDP1134 with 16K words of user space about 50 pairs and 20 questions can be accommodated.

Data storage capacity and speed of operation can be greatly enhanced by storing the raw data and the matrix S$ on a peripheral storage device such as disk or magnetic tape. To do this, replace lines 6 - 215 with instructions that open channels to the data files (created and filled in a separate program) and establish their dimensions. Be sure to let:

S%() = matrix for coefficients of compatibility
F$() = a file of female names
M$() = a file of male names
F%() = a file of female responses
M%() = a file of male responses

A line 599 must be included to close the channels to the data files before exiting from the program.

Activating the Punch Program. Line 1010 must be rewritten to conform to your particular software. It must open a channel to the paper tape punch device. The print statements in lines 1000 - 1640 may have to be modified to ensure that they are 'printing' to the punch. In this case, line 1010 opened the channel number 5 to the punch. The following print statements print to channel 5.

Special considerations for various paper tape punches. The punch program will operate on any paper tape punch that does not operate as part of a Teletype, differences in system software may produce different punched

(Continued on page 58)

slowly in the corridor by the ribbon amid giggles and moans as students reacted to the computer's choice for them.)

People Matcher's primary function is to find one match for each member of a group. Second, it finds truly compatible pairs. Note, People Matcher need not be used only for matching members of the opposite sex. All that's required is to have two equal-sized groups of people who have all responded to the same questionnaire.

How the program works

The program creates its matches by establishing "coefficients of compatability. If you want to guard against matching potentially incompatible people, you can modify the program to stop pairing people after a chosen coefficient has been reached.

The coefficients of compatibility are determined from the group members' responses to a questionnaire (See Sample Questionnaire) which you type in when the program runs (or enter as data in a virtual file).

The questions will obviously differ depending on the purpose for the matching; but the answers must be a number, from a scale that may range fron one to ten, chosen by the individual to represent their feelings.

In the Hotchkiss questionnaire, the respondents answered using a scale from one to seven where 1 meant "extremely important", 4 meant "no preference" and 7 meant "extremely unfavorable".

Where the dating questionnaire asked the respondent to rate the importance of physical attractiveness and lasting relationships, a tennis questionnaire, for example, might ask for a rating on the importance of winning versus playing for practice or fun.

To determine the coefficients you must also ascertain weighting factors to show the relative importance of any particular question. As with the others, the questions which bring out the weighting factors may ask whatever seems appropriate, but the answers in percentages, must add up to one hundred. *(Continued on following page)*

Sample Questionnaire for the People Matcher

NAME_____CLASS_____AGE_____SEX_____

Estimate the percentage of your time you devote to materialistic achievements (i.e. grades, status, money, etc._____

Estimate the percentage of your time devoted to dealing with people, problems, and relationships._____

(The above must total 100%)

RATE YOUR LEVEL OF PREFERENCE FOR EACH OF THE FOLLOWING DATING ACTIVITIES USING THE FOLLOWING SCALE: (1-strong preference 10-no liking of activity)

Camping_____Dancing_____Going to a sporting event_____

Going to the movies (not a drive-in)_____Going to a drive-in_____Going for a walk in the woods alone with your date, and nothing else_____Going to a party (w/ whatever)_____

Going to a party (no drinking/pot)_____Participating in an activity (tennis, bowling, kite flying, etc.)_____ Going out to eat_____

ANSWER THESE QUESTIONS USING A SCALE OF 1 TO 7.
1-Extremely important 4-No preference 7-Extremely unfavorable

(1) How important to you is the physical attractiveness of your date?_____

(2) How do you feel about kissing on the first date?_____

(3) How important to you is getting to know your date as opposed to just having a good time, regardless?_____

(4) How do you feel about having a lasting, meaningful relationship as opposed to having a short intense one?_____

How would you rate your level of compassion and caring towards others? (1-Very compassionate 10-Very self-centered)_____

How much do you worry about what others think of you? (1-Very much 10-Very little)_____

WOULD YOU PREFER THAT YOUR MATCH NOT BE PRINTED ON THE BULLETIN BOARD?

(Program notes continued)

sapes for a few of the alphanumeric characters because the PRINT command translates the CHR$ functions differently on different systems.

For example, under RSTS/E, PRINT CHR$ (4) produces : ·:· on the Teletype; on a stand alone punch it produces just one dot. Where differences occur, find the DATA statement corresponding to the character which is being printed incorrectly and experiment with the numbers until the desired effect is achieved. The numbers must be in the range of 0 to 255. If more than five of them are needed it must be printed as one of the special cases as in lines 1195 - 1240 and removed from the DATA.

When running under RSTS/E all software complications arising from using the Teletype can be overcome by typing the commands SET FORM, SET NO UPARROW and SET LCOUTPUT before using People Matcher.

Variable Table for the People Matcher

W, E, J, R, T, X, Y; all control variables for FOR/NEXT loops.

F$ ()	; female names
M$ ()	; male names
F% (,)	; female responses
M% (,)	; male responses
H	; highest coefficient of compatibility. Used in line 390 as the upper limit in the search for coefficients.
C	; coefficient of compatibility for the pair currently being being compared. Every male is compared to every female and C stores the coefficient until it is put in the matrix S. The lower coefficient, the more compatible the pair.
P1	; the sum of the percent value for material things given by the female and male currently being compared.
P2	; the sum of the percent value for human relationships given by the female and male currently being compared.
S% (,)	; matrix storing the coefficients of compatibility. Row positions correspond to females; column positions correspond to males. S% (3, 9) stores the coefficient of compatibility between the third female and the ninth male.
T1	; counts the number of pairs completed and is used to stop the search for more pairs as soon as the desired number is reached.
A$	; the total string to be punched out, e.g., ELLEN SMITH and GARY JONES.
B$	; the alphanumeric characters from A$ currently being worked on.
C$	; the alphanumeric character B$ is being compared with.

Program Listing

```
DATES   12:18 PM        05-Apr-78
1 REM PEOPLE.MATCHER, WRITTEN BY HARRIET MORRILL, COMPUTER COORDINATOR
2 REM THE HOTCHKISS SCHOOL, LAKEVILLE, CONNECTICUT 06039
3 REM WRITTEN IN APPLESOFT (FLOATING POINT BASIC) AND RSTS/E BASIC PLUS
5 REM ON A PDP 1134 RUNNING RSTS/E VERSION 6B
6 DIMF$(50),F%(50,18),M$(50),M%(50,18),S$(50,50)
7REM TAKE IN THE RAW DATA;NO. OF MALES AND NO. OF FEMALES MUST BE EQUAL
8 INPUT "HOW MANY PAIRS DO YOU WISH TO CREATE";Z
9INPUT "HOW MANY QUESTIONS HAVE BEEN ASKED";Q
10 FOR W = 1 TO Z
11      INPUT "FEMALE NAME";F$(W):PRINT F$(W);"'S REPLIES:"
12      FOR E = 1 TO Q
14              PRINT "REPLY NO.";E;:INPUT F%(W,E)
15      NEXT E
```

The Hotchkiss questionnarie began by asking what percent of the respondent's time was spent in pursuit of material things and what percent was devoted to personal relationships. Your tennis questionnaire might ask the respondent to rate 1) how much time they spend practicing and 2) how much time they spend playing.

Once you input the responses, the computer finds the coefficient of compatibility by squaring the difference between two people's answers to a question and then multiplying the result by the sum of the indicated weighting factors for the specific question. Calculated in this manner, the coefficients for each question are then totaled to find the final coefficient of compatibility for that pair. This number is stored in a matrix and the process begins again for another pair in the group.

Once all the possible pairs have been given a final coefficient, the computer prints out the names of couples starting with the most compatible (those that have the lowest coefficient of compatibility). The coefficients themselves are never revealed by the computer.

The People Matcher program is written in BASIC so that it conforms to Applesoft (extended precision floating point). It is also compatible with RSTS/E BASIC PLUS versions 6a and 6b. (The Program Run was made under RSTS/E on the PDP-11/34 at Hotchkiss.)

The paper tape punching routine is a program called "Punch" written by Andrew Hickmott, a Hotchkiss student, and appended to the main program. Punch is presented here in the final lines of the program 1000 to 1630.

People Matcher can be an amusing and successful tool. And it illustrates, once again, that the computer is only as smart as the data and the processing algorithm programmed into it. □

For further information please contact Mrs. Harriet Morrill, director, The Hotchkiss Computer Center, The Hotchkiss School, Lakeville, CT 06039.

(Program listing continued)

```
16NEXT W
18FOR W = 1 TO Z
20      INPUT"MALE NAME";M$(W):PRINT M$(W);"'S REPLIES:"
22      FOR E = 1 TO Q
24              PRINT "REPLY NO.";E;:INPUT M%(W,E)
25      NEXT E
26NEXT W
27 FOR W = 0 TO 50:S%(W,W)=0:NEXT W
29 PRINT:INPUT"TYPE T FOR PAPER TAPE PUNCH OF RESULTS";O1$
30 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
32 PRINT"                    THE HOTCHKISS COMPUTER CENTER"
40 PRINT"                                PEOPLE MATCHER"
42 PRINT:PRINT:PRINT
215 REM FIND THE COEFFICIENT OF COMPATIBILITY FOR ONE PAIR
220 H = 0
235 C = 0
240 FOR R = 1 TO 50
250     FOR W = 1 TO 50
251     P1 = F%(R,1)+M%(W,1)
252     P2 = F%(R,2)+M%(W,2)
265 REM SQUARE THE DIFFERENCES AND MULTIPLY BY THE PERCENT WEIGHT FACTOR
266 REM RELEVANT TO QUESTIONS 3 THROUGH 12
270     FOR E = 3 TO 12
290             C=C+INT(((F%(R,E)-M%(W,E))^2)*P1)
310     NEXT E
311 REM SQUARE THE DIFFERENCES AND MULTIPLY BY THE 2ND WEIGHT FACTOR
312 REM WHICH RELATES TO QUESTIONS 13 THROUGH 18
313     FOR E = 13 TO 18
315             C=C +INT(((F%(R,E)-M%(W,E))^2)*P2)
316     NEXT E
323 REM CHECK FOR HIGHEST COEFFICIENT,PUT COEFFICIENT IN MATRIX S
326     IF C<H THEN 350
330     H = C
350     S%(R,W)=C
360     NEXT W
370 NEXT R
380 REM SEARCH THROUGH MATRIX S FOR BEST MATCHES
384 T1 = 0
390 FOR J = 0 TO H
400     FOR W = 1 TO 50
410             FOR E = 1 TO 50
420             IF S%(W,E)<>J THEN 580
490 REM ELIMINATE THE ROW AND COLUMN OF THE PAIR JUST MATCHED
500             FOR T = 1 TO 50
520                     S%(W,T)=-1
530                     S%(T,E)=-1
540             NEXT T
560             PRINT F$(W);" AND ";M$(E):PRINT
562             IF O1$<>"T" THEN 565
563             GO SUB 1000
565             T1 = T1 + 1
568             IF T1 = 50 THEN 1640
580             NEXT E
590     NEXT W
592NEXT J
600 GO TO 1640
1000 REM ***PUNCH PROGRAM BY ANDREW HICKMOTT, HOTCHKISS'79
1010 OPEN "KB2:" AS FILE 5
1040 A$ = F$(W)+" + "+M$(E)
1049 FOR Y = 1 TO 10
1050    PRINT #5,CHR$(0);
1051 NEXT Y
1060 FOR X = 1 TO LEN(A$)
1070 RESTORE
1080 B$=MID(A$,X,1)
1090 IF B$<>" " THEN 1120
1109 FOR Y = 1 TO 5
1110    PRINT#5,CHR$(0);
1111NEXT Y
1115 GO TO 1160
1120 READ C$,A,B,C,D,E
1130 IF C$="*" THEN 1200
1140 IF C$<>B$ THEN 1120
1150 PRINT #5,CHR$(A)+CHR$(B)+CHR$(C)+CHR$(D)+CHR$(E)+CHR$(0);
1160 NEXT X
1179 FOR Y = 1 TO 10
1180    PRINT#5,CHR$(0);
1181 NEXTY
1190 RETURN
1195 REM SECTION FOR SPECIAL CASE REQUIRING MORE OR LESS THAN FIVE CHR$'S
1200 IF B$ = "!" THEN PRINT #5,CHR$(0)+CHR$(190)+CHR$(0);
1210 IF B$ = "." THEN PRINT #5,CHR$(0)+CHR$(128)+CHR$(0);
1220 IF B$ = "1" THEN PRINT #5,CHR$(132)+CHR$(254)+CHR$(128)+CHR$(0);
1230 IF B$ = "(" THEN PRINT #5, CHR$(56)+CHR$(68)+CHR$(130)+CHR$(0);
1240 IF B$ = ")" THEN PRINT #5, CHR$(130)+CHR$(68)+CHR$(56)+CHR$(0);
1250 GOTO 1160
1260 DATA A,252,10,10,10,252
1270 DATA B,254,138,138,138,116
1280 DATA C,124,130,130,130,68
1290 DATA D,254,130,130,130,124
```

(Program listing continued)

```
1300 DATA E,254,138,138,138,130
1310 DATA F,254,10,10,10,2
1320 DATA G,124,130,130,146,116
1330 DATA H,254,8,8,8,254
1340 DATA I,130,130,254,130,130
1350 DATA J,64,128,128,128,126
1360 DATA K,254,16,40,68,130
1370 DATA L,254,128,128,128,128
1380 DATA M,254,4,8,4,254
1390 DATA N,254,4,8,16,254
1400 DATA O,124,130,130,130,124
1410 DATA P,254,10,10,10,4
1420 DATA Q,60,66,98,66,188
1430 DATA R,254,10,10,26,228
1440 DATA S,68,138,146,146,100
1450 DATA T,2,2,254,2,2
1460 DATA U,126,128,128,128,126
1470 DATA V,14,112,128,112,14
1480 DATA W,126,128,112,128,126
1490 DATA X,198,40,16,40,198
1500 DATA Y,2,4,248,4,2
1510 DATA Z,194,162,146,138,134
1520 DATA ?,4,2,178,10,4
1530 DATA 2,132,194,162,146,140
1540 DATA 3,68,130,138,138,116
1550 DATA 4,14,8,8,8,254
1560 DATA 5,78,138,138,138,114
1570 DATA 6,124,146,146,146,96
1580 DATA 7,2,2,242,10,6
1590 DATA 8,116,138,138,138,116
1600 DATA 9,68,138,138,138,124
1610 DATA 0,112,136,136,136,112
1620 DATA -,8,8,8,8,8
1625 DATA +,8,8,60,8,8
1630 DATA *,0,0,0,0,0
1640 END
```

Program Run

```
HOW MANY PAIRS DO YOU WISH
   TO CREATE? 3
HOW MANY QUESTIONS HAVE BEEN
   ASKED? 4
FEMALE NAME? HARRIET
HARRIET'S REPLIES:
REPLY NO. 1 ? 30
REPLY NO. 2 ? 70
REPLY NO. 3 ? 3
REPLY NO. 4 ? 1
FEMALE NAME? ELLEN
ELLEN'S REPLIES:
REPLY NO. 1 ? 60
REPLY NO. 2 ? 40
REPLY NO. 3 ? 4
REPLY NO. 4 ? 1
FEMALE NAME? MOLLY
MOLLY'S REPLIES:
REPLY NO. 1 ? 80
REPLY NO. 2 ? 20
REPLY NO. 3 ? 5
REPLY NO. 4 ? 1
MALE NAME? JIM
JIM'S REPLIES:
REPLY NO. 1 ? 100
REPLY NO. 2 ? 0
REPLY NO. 3 ? 5
REPLY NO. 4 ? 2
MALE NAME? GARY
GARY'S REPLIES:
REPLY NO. 1 ? 70
REPLY NO. 2 ? 30
REPLY NO. 3 ? 4
REPLY NO. 4 ? 2
MALE NAME? ROCK
ROCK'S REPLIES:
REPLY NO. 1 ? 0
REPLY NO. 2 ? 100
REPLY NO. 3 ? 5
REPLY NO. 4 ? 5

TYPE T FOR PAPER TAPE PUNCH
   OF RESULTS? T


HARRIET AND JIM
ELLEN AND GARY
MOLLY AND ROCK
```

Picking a Printer

BY CHIP A. TYETI

You may have had your micro up and running for the past three years using a CRT display for output, but now you see the need for hard copy output. That Polaroid photograph of the picture tube just doesn't make it as a workable document. Before you make a rash decision about which printer best suits your needs, review the basic categories of printers, the specific mechanisms that make them work, the prices, speed, the quality of the output, the reliability of the manufacturer and their corresponding service, and most significantly, the application for which you intend to use this printer.

Printing mechanisms and printers have advanced at phenomenal rates in the past 10 years and are likely to continue at the same pace for the next 10 or more years. Realistically, you must consider the reason you need hard copy, then apply all the selection factors. Discuss the possibilities with friends, dealers and the manufacturers, as you would any capital investment for your home or business.

We'll describe for you the various criteria for selection, review the printer categories, evaluate some of the more popular units available and discuss briefly the most recent technologies in the printer field.

Three major classifications are used to define printers: serial vs. line, impact vs. non-impact and dot matrix vs. whole character image.

Serial printers produce a single character at a time, usually moving from left to right across the page. (Several manufacturers now offer printers that move in both directions, providing the most efficient printing method.) Line printers, on the other hand, appear to print an entire line simultaneously.

The second major classification, the impact printer, as the name suggests, brings the character element in contact with the paper, sandwiching an inked ribbon between them. The non-impact printer uses either electrical, thermal, chemical or optical methods to transfer images to paper. In many instances, the paper used in the non-impact printers is either coated or treated and costs more than regular paper.

In the third classification are dot matrix characters which are comprised of dots within a 5 x 7, 7 x 9 or other size matrix. Whole characters are shaped and continuous in their image. The majority of printed images falls into this category.

As you review this article, be aware of the potential tradeoffs you must make. For example, speed decreases with increased image quality; and price increases directly with speed and sometimes with image quality (especially with the latest printing technologies). There are no established formulae for determining what is best, except keeping in mind *your needs within your application.*

Printing mechanisms range from under $100 to well above $300,000. We'll discuss only those printers that cost under $4000, but the printing mechanisms described cover all technologies available today.

Beyond the cost of the unit itself you must consider expendables and maintenance. Paper, ink or ribbons, print heads, maintenance supplies and a service contract are a few of the additional expenses you must include in your original cost estimate. Several mechanisms are naked, so the purchase of an enclosure is often an additional necessity.

The slowest printers generate characters at about 15 per second. The fastest printers can generate over 21,000 lines (of about 132 characters) per minute. That's about four and a half feet per second. (It is also well beyond our price range.) The faster the printer, the more complex the printing mechanism and the more expensive the device.

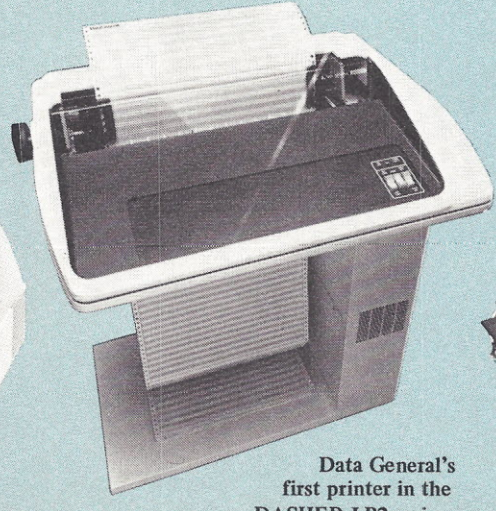
If you plan a limited amount of output (possibly doing all your preparation on the CRT), a Selectric-type device might be best. If you have extensive charts, graphs or alphanumeric data, a dot matrix line printer could fill the bill.

Keep in mind the data transmission rates from your micro. If your printer doesn't have adequate buffer but uses a high baud rate, a faster printer is in order.

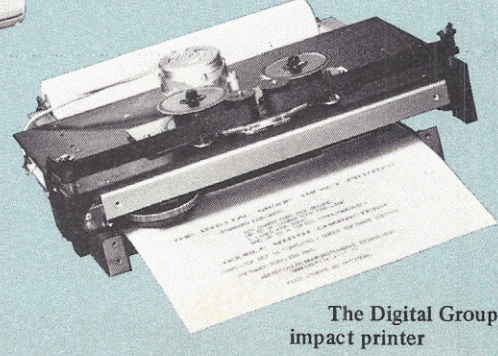
As we mentioned earlier, dot matrix



The B-300 band printer from Dataproducts



Data General's first printer in the DASHER LP2 series



The Digital Group's impact printer

characters are generally poorer quality than whole or shaped characters. The few very high quality dot matrix printers, such as the Sanders Technology Systems' typographic printer, use a highly refined dot matrix imaging technique, resulting in typographic quality and incredible versatility in size and imaging patterns as well as flexible type fonts. Quality may be paramount if you have business applications where invoices, letters, statements and other communications are sent outside your home office. Internal information may be printed on lesser quality machines.

When comparing the reliability of the product and the company, especially the manufacturer's service after the sale, you are faced with deciding to buy from mail order, a retail store with service available, or a local rep or distributor with service on call.

Many new companies are jumping on the bandwagon, and major manufacturers like IBM, Diablo, Dataproducts, Teletype, Centronics, Texas Instruments, Honeywell and Control Data have been there for years. Many of these newer companies have already developed a solid reputation for service and quality, and several others are rapidly approaching that same level of reliability. We've included in our chart companies which you can rely on for good service and quality workmanship, determined through discussions with dealers, customers and manufacturers.

Consider some additional factors when planning the purchase of a printer for your system: font changes, noise levels, multiple copy capability and character registration. Graphics availability, interfacing requirements and physical size of the printer are additional factors to ponder.

With Selectric-type elements, changing the type face is relatively simple and fast. The daisy wheel is equally easy to change, but on just about all other whole character impact printers, it is noticeably more difficult to change fonts.

With dot matrix printers, changing a type font is a software-controlled function. Usually the software is in ROM and can be changed within a minute by simply changing the ROM chips.

Non-impact printers create much less noise than impact printers – thus non-impact printers are often used in hospitals, law offices and other locations where noise levels should be minimal. Available for impact printers is a soundproofing material or enclosing cabinet which reduces noise levels remarkably well. You might even experiment with the impact printer you buy, trying to lessen the noise it generates with foam padding, insulation or other sound absorbing material. Don't do this without keeping vents open, wires and levers unobstructed and mounting hardware free from excess material.

If you must generate more than one copy, you should consider the value of a dot matrix impact printer over a whole character impact printer. Non-impact printers can't produce multiple copies simultaneously; but manufacturers suggest rerunning the print program again to regenerate a copy. If that procedure is not efficient for your application, the dot matrix impact printer is the next best choice. Here, uniformity of impact of the dot matrix impact printer vs. the lack of uniformity of the whole character printer plays an important role. An "M" struck on a whole character machine hits with the same force as a period or comma. However, the force of the M is spread out over a larger surface, reducing the impact. When you make more than one copy, characters on the last few copies will be noticeably fainter than the characters on the first few copies. With a period or comma, the surface area is smaller and therefore the impact is greater – sometimes to the point of actually embossing the surface of the paper. Thus periods and commas on your last few copies will appear heavier than on the first few. Darkness and quality of other characters will vary in inverse proportion to the total surface area of the character and the number of carbon copies.

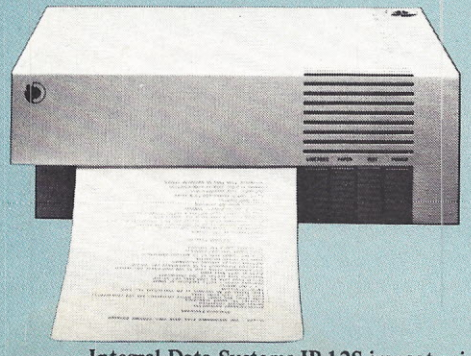
A dot matrix character has the same impact on the paper and carbons with an "M" as does a period or comma. Each dot hits the paper with the same force, regardless of how many dots make up the character. Carbons from dot matrix printers are significantly more legible than carbons from whole character printers.

Character registration is particularly important for communications outside your company. With drum printers, the characters are apt to be vertically out of alignment, which is more noticeable to the eye than horizontal alignment. In fact, most "justified" copy uses variable spacing not only between words but also between letters to provide aligned left and right margins. We rarely notice how much space variability there is in justified copy. All other printers but the drum mechanism use horizontal alignment, not vertical.

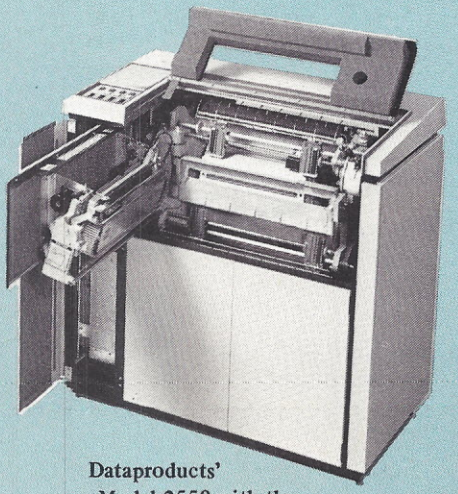
Graphics capability on a whole character printer is difficult and awkward to achieve. Graphs and charts must be composed from ASCII characters – for example, asterisks, dashes, vergules, periods and underscores. Delicate variations in data cannot be well represented on such graphs, if the graphs stay within reasonable sizes.

Dot matrix printers, on the other hand, offer greater flexibility in that any configuration of the 5 x 7 or similar matrix can print. In addition, shading densities can be created to indicate different conditions, and any character can be software-generated and repeated as needed.

Whole or shaped character printers create portraits in one of the latest enterprises to spin off microcomputer technology. Usually, a low resolution camera is attached through a microcomputer to a high-speed printer. The microcomputer (or microprocessor) uses the visual density of the ASCII characters to match with the density from the TV camera. The resulting im-



Integral Data Systems IP-12S impact printer



Dataproducts' Model 2550 with the charaband print drive



M-200 matrix printer from Dataproducts Corp.

age, viewed from a few feet away, shows a remarkable likeness of the subject. This technique would not be as effective with dot matrix printing, because character densities are not as well defined as in the whole character printers.

Electronic interfacing of most printers to a microcomputer requires an RS-232C or current loop. Some printers designed for specific micros (e.g., the Apple II) contain their own unique interfacing electronics. Nearly all printers have self-contained power supplies, but where they do not, you need additional obvious interfacing. Don't shortchange the power supply you must interface. A weaker unit could contribute to frequent breakdowns; a stronger power supply will assure even greater expansion capability.

Some printers are available in tiny packages – and not necessarily in enclosures. Often these units print only numeric or limited alphanumeric data and would never fulfill your needs for typical hardcopy output. When only the limited characters suffice, you might find that a small printer can be mounted within your micro's enclosure, thus assuring protection and containment.

Other printers rest on the floor or on their own dolly or cart. Most printers simply sit on a table or bench, taking up a little more space than a 15"-carriage IBM Selectric typewriter.

Printer Classifications

Cylinder Printing Mechanism: TTY (teletype) is the perfect example of a cylinder printing mechanism. It's low-cost, but very noisy. Acoustical housing is available so noise can be kept at a minimum, but we've never seen a teletype that, no matter how well it was sound-insulated, didn't let you know it was around.

Several companies offer new (Teletype Corporation) and reconditioned (Teletypewriter Communications Specialists) units. There are lease plans available as well as rental and purchase options. The cylinder sits vertically with a complete character set embossed on the surface in three, four or more bands. These cylinder printers are slow and the print quality is relatively poor. You can purchase units from about $800 to $2400.

Spherical Element Printing Mechanism: IBM developed a spherical printing element (commonly called a "golf ball") which they use in their Selectric typewriters and composers. Regulated in its position by a pitch control (vertical movement) and a rotation control (horizontal movement), the spherical printing element prints about 15 characters per second (cps) – compared to other types of printers, it is somewhat noisy.

A significant factor in these units is the ease with which an operator can change the type fonts or character sets. If you plan to use your micro for power typing letters or extensive text operations, the Selectric-type printer may be ideal.

Microcomputer Devices of Anaheim, CA, sells the Selectraterm which is an IBM Selectric II (with optional correcting feature) with all electronics and power supply included. The Selectraterm is the only available printer for micros that is actually a typewriter as well – and one of the best in quality and engineering. The carbon ribbon copy from the unit is camera-ready for offset printing. A 90-day warranty is included with this printer, and yearly service agreements for the typewriter are available from IBM. Many computer retailers have the Selectraterm available, but options such as the correction feature, dual pitch, tractor feed platen and a noise reduction feature may require more lead time from the manufacturer.

The typing element on the Selectraterm is a special ASCII element, but if you have word processing software in your micro, you could output copy in italic, sans serif, condensed, OCR code, or about 20 other styles. The Selectraterm comes in beige or blue and sells for $2000.

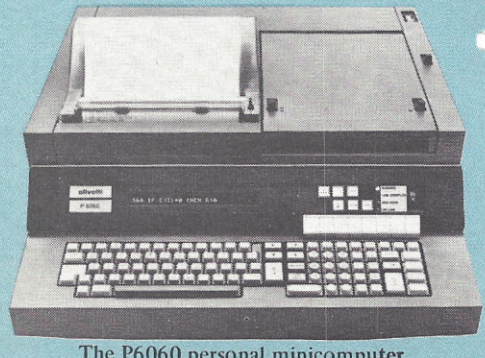
Several surplus stores, for example the Computer Warehouse of Boston, MA NCE/Compumart of Ann Arbor, MI, and Rondure Company of Dallas, TX, sell IBM Selectric terminals/printers that only need minor modifications for interfacing with your micro.

Occasionally, you may find terminals or printers that use the basic IBM I/O typing mechanism, but are labeled NOVAR or Edityper. IBM was the OEM supplier and the designated manufacturer added his cosmetics and electronics to suit the specific needs of his product. Edityper units are available from Edityper Systems of Fairfield, NJ. These units contain fully converted I/O IBM Selectric mechanisms and can be placed under IBM service contracts.

Daisy Wheel Printing Mechanism: Xerox's subsidiary, Diablo, introduced the daisy wheel in 1972. Printing applications are the same for these units as for cylinder and spherical mechanism printers. Speed on a daisy wheel printer is two to four times that of spherical element printers, but print quality suffers compared to Selectric element printers.

Qume began offering daisy wheel printers in 1973, and in 1977 introduced the "Twintrack" printer which uses two daisy wheels that operate independently of each other but concurrently in the most efficient pattern according to the microprocessor in the printer. This Twintrack system can simultaneously print two languages (even with alphabets as different as Sanskrit and French). The printer is also excellent for translations.

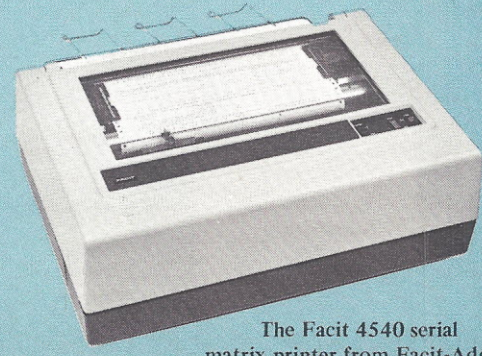
Not all daisy wheel printers use microprocessors, but whether it is a μP or LSI chip , the circuitry is designed to move the print mechanism in the shortest and most efficient bi-directional move. Qume recently introduced their Sprint 5 microprocessor-controlled daisy wheel printer in both a keyboard send-receive unit (KSR) and a receive-only (RO) printer. The price range is from $2900 to $3300, and the print quality is said to be equal to the most



The P6060 personal minicomputer with integrated printer from Olivetti



Data Test's Model 300 line printer



The Facit 4540 serial matrix printer from Facit-Addo

sophisticated and highest quality office typewriter.

Agile Corporation of Sunnyvale, CA, offers the A1 Data Communications Terminal as a daisy wheel printer for $3475. The A1 also has a built-in microprocessor, provides plot software as an option and can move the carriage as little as 1/120th of an inch.

Applied Computer Systems of Sunnyvale, CA, markets the Smart Alec Series SA 300 which can use either the plastic daisy wheel, the metal wheel or the Twintrack. The Smart Alec has additional I/O ports for use with additional equipment.

Data Terminals and Communications of Campbell, CA, has introduced their DTC-382 video printer terminal. It includes a CRT display monitor with an 80 x 24 character field per display page and may store up to four pages of text.

Drum Printer Mechanism: The drum printer mechanism is simply a cylindrical drum significantly larger than that used in the cylinder print mechanisms and rotating on its horizontal rather than vertical axis. As a character moves into position on the drum a sensor triggers a hammer to fire against the paper from the backside of the unit. The ribbon is sandwiched between the drum and the paper. The only major disadvantage is the potential vertical misalignment of characters. The cost of some drum printers can run over $75,000, but we have listed two on our chart that sell for $500 or less. These printers are usually very reliable and quite practical for small applications.

The Series PR 15 and 21 column alphanumeric printer, selling for $120 per unit, utilizes one hammer for three columns of data, thus reducing required drive electronics. This printer, by Sheldon-Sodeco Printer Division of Landis & Gyr, Inc., Elmsford, NY, uses standard paper and prints at 10 lines per second (lps).

The simple, reliable Model 444 by Computer Terminal Systems sells for $500.00. It is a strip printer at 15 cps.

Belt or Band Printing Mechanism: The belt printing mechanism is so named because of the belt or band made of steel or reinforced polyurethane that rotates continuously on a horizontal axis. Precisely timed hammers fire against the paper, sandwiching the ribbon and impacting against the belt on the other side of the paper. If one character is damaged or worn, the entire belt must be replaced. Mechanical design contributes to excessive drive wear and sometimes low print quality as well.

Occasionally, horizontal misalignment occurs, but people don't recognize this as much as the vertical misalignment of the drum printer. Printers in this category may be too expensive for microcomputers – the tail wagging the dog!

Data Test Corporation of Concord, CA, offers their DT 300 line printer, which generates 300 lines per minute and sells for $5595 in 132 column printers and $4495 in 80 column printers. This table-top printer includes a self-test and has an automatic start-up and shut-down. The DT 300 offers optional print sets, tractor feed and pedestal.

This high speed printer is excellent for high output from a small business microcomputer system, but is a little too much for most hobbyists.

The charaband printer from Dataproducts of Woodland Hills, CA, is significantly more efficient than the band or belt printer because the print slugs ride on ball bearings, causing much less wear and friction.

Sometimes, depending on specific design, other printers within this category are referred to as "train" or "chain" printers. Essentially the technology is the same.

Matrix Printing Mechanisms: The matrix comb and the serial matrix printers use dot matrices to produce characters. The matrix comb oscillates across the paper, generating a little more of the specific character with each movement. If the vertical resolution is high, the characters begin to look like whole character sets – that is, like standard typewriter characters.

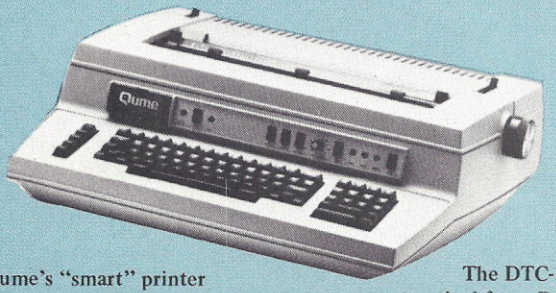
The serial matrix printer usually uses a print head with seven pins. As the print head moves across the paper, one line, seven dots high, is printed. Matrix printers usually work on the electrostatic principle.

Dot matrix printers are ideal when you need large character sets or special type fonts. The noise output of these printers is comparatively high, but you can insulate these printers more effectively than most other varieties. Although manufacturers have said matrix comb printing heads move less than serial matrix printing heads, thus wearing out less, the replacement costs should run under $20. Matrix printers are offered with both impact and non-impact mechanisms. Non-impact printers usually involve either thermal, electrostatic, or other principles which we will review later on.

In the category of impact dot matrix printers, we have the Facit 4540 Serial Matrix Printer, which uses a 9 x 9 print head with hammers. The 5440's floating print head self-adjusts to the number of carbon copies.

Data General offers an entire family of matrix printers, beginning with the $2200 model 6043 (RO). The carriage is driven by a lead screw mechanism, insuring precise horizontal and vertical registration. Model 6042 is the KSR version. It has a standard typewriter keyboard with an off-line mode that enables the printer to act as a typewriter.

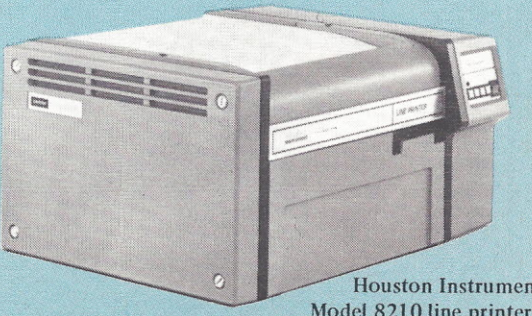
Malibu Design Group's No. 160 matrix impact printer uses a 9-pin printing head vertical arrangement to generate the matrix. Ball bearing races for the print head carriage save considerable wear and tear. Re-inking rollers extend the ribbon life to 50 million characters. Alphanumeric output can fill one inch with ten characters or one 11" x 14" sheet of printout with a



Qume's "smart" printer terminal, the Sprint 5 (KSR)



The DTC-382 video terminal from Data Terminals & Communications



Houston Instruments Model 8210 line printer

single character. This feature, of course, is software controlled.

Victor Data Products markets the 5000 Data Terminal, a 34-column ASCII printer with characters pitched at a 10 degree angle for easy reading. A tractor feed for gummed labels, perfect for addressing and inventory labeling, is available for this printer.

Lear Siegler, Inc., offers a high-caliber machine in their 200A Series Ballistic Printer. The patented ballistic print head drastically increases head life because no moving cores are attached to the print wires. Instead, it uses armatures to ballistically propel the matrix wires in free flight to the platen. This feature is remarkable for a high speed matrix impact printer.

Commodore Business Machines (the company holding the leash on the PET) say they plan to market their yet unamed, $595 PET graphics printer. It uses special secondary addresses which allow transmission of a format string and editing numeric and alpha data per that format. This PET printer also offers reverse field printing, a line per page set command and auto-paging. The character set includes upper and lower case ASCII and PET graphics. This economical machine offers versatility. We look forwarded to seeing this printer, and with symbols for hearts, clubs, spades and diamonds – bridge anyone?

The IP-125 Impact Printer by Integral Data Systems includes options for software-selectable character sizes, graphics and buffers for full CRT page printing. The user's manual is extensive and clearly presented – a definite plus when trying to interface any printer and get it running. This matrix printer is simple and clean in its design. It is also easy to operate.

The Digital Group's PT-96 COMP Printer is totally computer controlled by either 8080 or Z-80 software. The character set and pitch are variable and under software control. You can buy this one either assembled or in kit form – though even in kit form most of the unit is already assembled. This unit (which doesn't include a keyboard) is an attractive, unpretentious piece of equipment for the office or home.

SCI Systems has an incredibly compact machine that sells for $243 and prints about 2200 cps. The Model 1100 Rotary Printer measures only 4" x 5" x 9" and weighs only 3 pounds. The manufacturer says the printing head can be easily and quickly replaced, and the printer itself is extremely reliable.

Thermal Matrix Printers: Thermal matrix printing mechanisms have been used for several years in compact handheld calculators. Thermal printing is certainly the slowest, but at the same time, least expensive and quietest of all non-impact machines. The special heat-sensitive paper needed costs more than ordinary stock.

The PS-48-C Thermal Printer by Telpar, Inc., $666 for a receive-only version, interfaces to bit parallel or bit serial ports. This 48-column printer also interfaces to a keyboard to yield a full duplex I/O terminal in serial mode. The data signalling rates are either 110 or 300 baud in serial mode or up to 960 cps in parallel mode.

Guilton Industries manufactures a line of thermal printers which are extremely quiet and reliable because the only moving part is the drive mechanism. The manufacturer says low cost printers are available completely packaged or as print mechanisms only. When we asked the MTBF (mean time before failure – currently an infrequently used expression), the Guilton people said about 20 million characters, which certainly speaks well of failure frequency.

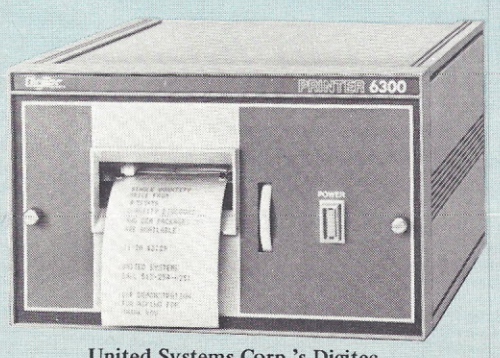
The Pussycat Model 650 CRT Page Printer, T50-300, is the popular Perkin-Elmer entry into the thermal matrix printer field. This fixed thermal head printer has exceptional clarity in upper and lower case – full descenders. There is only one moving part in this entire printer – the platen!

Electrographic and Electrostatic Printers: Both of these printing mechanisms use a specially coated paper and create images through voltage changes through the tip of the stylus or nibs of the printer. Both electrographic and electrostatic processes can be either wet or dry, but both are high in speed. Those mechanisms are used in some of the least expensive printers as well as some of the most expensive printers.

Centronics Data Computer Corporation introduced their Microprinter about a year ago with either the parallel or serial interface. This little gem is quiet, simple, durable, compact and light-weight and there are only four moving parts. It generates software-controlled characters at 150 lpm. An audible alarm signals low paper.The paper used with this unit is coated with a layer of conductive aluminum which is vaporized by a low-voltage discharge from the print head to produce highly readable characters. The paper is unaffected by prolonged exposure to light, impervious to grease and water. Output from this printer can be reproduced on standard office copying equipment. The Microprinter Model P1 or S1 is worth investigating further.

Houston Instrument's 8200 Series Line printer, Model 8230, offers the fastest known printing available for micro- or minicomputers – 1400 lines per minute. Houston Instrument also makes a digital plotter for personal computing, the Microplotter 2, which comes complete with RS-232C interface and sells for $1095. It has an 8½" x 11" page size, 0.005 or 0.01 inch resolution and is complete and ready to run. Check this one out – even though it's technically not a printer.

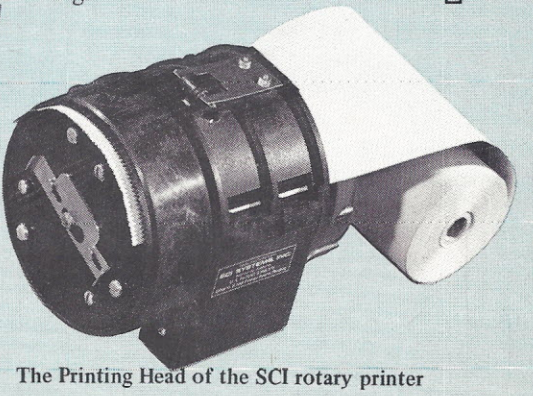
As you can see, there is a variety of criteria and specifications for you to consider when researching printers compatible with microcomputers. Buying a printer can be a healthy challenge to anyone into personal computing. □



United Systems Corp.'s Digitec 6300 series alphanumeric printer



Printer No. 160 from Malibu Design Group



The Printing Head of the SCI rotary printer

Printer Particulars

Company Name	Catalogue Number	Printer Name	Available From	Availability	Price	No. of Printing Columns	Max. Speed	Max. Li./In. (H)	Char./In. (W)	Ink Colors Available	Graphics Capability?	Multiple Copies?	Printer Mechanism
ADDMASTER		Wide Printer	For. DS	2	$ 88.	6-22 singl	3LPS	4½ in	6½ in	blk, red	no	+	cylinder
ADDMASTER	model 56	Dual Printer	For. DS	2	88.	6-10 dual	3LPS	4½in	6½in	red+blk/pur	no	+	cylinder
AGILE CORP.	A1	—	RP	1	3475.	132; 158	10-55 CPS	6-8	10-12	—	yes	yes	daisy wh'l
ANADEX	DP1000		RP	1	570.	40	50CPS	.112"	12	purple	no	yes	serial matrix
ANDERSON-JACOBSON	AJ841I/O	Refurbished IBM Selectric	MF	+	995.	130/ 156	14.9 CPS	10	10	all IBM ribbon colrs.	no	yes	spherical elem
ANDERSON-J.	AJ630RO	—	—	+	2765.	140	30CPS	6-8	10	—	no	—	electrothrml
ANDERSON-J.	832	—	—	—	—	132, 158	30, 45CPS	6-8	10,12	—	yes	no	daisy wheel
ANDERSON-J	860	—	—	—	—	132	60;120CPS	6	10	—	yes	4+1	serial matrix
ANDERSON-J.	DP-1000	—	—	—	—	140	30CPS	6	10	—	no	1+1	thermal matrix
APPLIED SYSTMS COMP.	SA300	—	RT,MO, DS,RP	1	4500.	158	55CPS	V	10-12P	blk, red, blu	yes	yes	daisy wh'l
APPLIED COMP. SYSTEMS	900	—	—	1	2895	132; 156	120CPS	6	10; 12OP	—	—	—	serial matrix
AXIOM	EX-800	—	—	—	655.	80	120LPM	6	20	—	yes	no	electrosnstve
AXIOM	EX-201	High Speed Fxd.Hd.Pr.	—	—	—	—	800CPS	—	—	—	—	—	—
AXIOM	EX-810	—	—	—	795.	80	160CPS	8	20	—	yes	no	electrosnstve
CENTRONICS	S1	Microprinter	DS	1	695	80	150LPM	10	5,10,	blk on Al	no	no	electrosnstve
CENTRONICS	P1	Microprinter	RP	1	595.	80	150LPM	10	20	blk on Al	no	no	electrosnstve
CENTRONICS	series 700	—	DS	1	—	80	60-	10	10+	blk +	yes	yes	serial matrix
CENTRONICS	series 700	—	RP	1		-132	180CPS	10	10 +	blk +	yes	yes	serial matrix
CENTURY DATA PRODUCTS	—	Matrix Prntr	—	—	427.	40	90LPM	—	—	—	—	—	—
COMMODORE BUSI. MACH.	—	(not yet assigned)	RT	2	595.	80	120CPS	.110"	10 or	blk, +	yes	yes	serial matrix
			MO	2	595	80	120CPS	.110"	5	blk, +	yes	yes	serial matrix
COMP. DEVICES	1201-03	—	—	—		80	30CPS	6	10	—	—	no	thermal
COMP. DEVICES	1204,1205	—	—	—		80	35CPS	6	10	—	—	no	thermal
COMP. TERM'L	model 444	Strip Printer	DI	1	500.		15CPS	8	10	—	—	no	drum
SYSTEMS	model 444		RP	1			15CPS	8	10	—	—	no	drum
COMP. USAGE SERV. INC.	3240	—	—	—		132	300LPM	6	10	—	—	1+5	serial matrix
*COMPUTER WAREHOUSE	DEC LS120	Decwriter III (new)	RT	1	2695.	132	180CPS	.1"	10	blk	no	1+5	serial matrix
*COMPUTER WAREHOUSE	DEC LA36	Decwriter II (new)	RT	1	1495.	132	30CPS	.1"	10	blk	no	1+5	serial matrix
*COMPUTER WAREHOUSE	101A	Centronics PR (used)	RT	1	1250.	132	165CPS	.1"	10	blk	no	1+5	serial matrix
CONTROL DATA	9317	—	—	—	2035.	132	180CPS	6-8	10-16	5 —	—	1+5	serial matrix
CONTROL DATA	9318	—	—	—	2535.	132	180CPS	—	—	—	—	1+5	serial matrix
DATA 100 CORP.	1420	—	—	—	—	132	300LPM	6,8	10	—	—	1+5	belt
DEC	LA36	Decwriter II	—	—	—	132	30CPS	6	10	—	—	1+5	serial matrix
DEC	LS120	Decwriter II	—	—	—	132	180CPS	6	10	—	—	1+5	serial matrix
DATACQ	388 series	Precisa	RP	1	155.	21	3LPS	.118"	8	red & blu	no	no	cylinder
DATA ROYAL	7000;7200	—	—	—	—	—	120CPS	6	10	—	no	1+5	serial matrix
DATA ROYAL	IPS-7	—	—	—	—	132	120CPS	6-9	10	—	no	1+5	serial matrix
DATA TERM'LS	382	—	RT,DS	1	3750.	132	55CPS	Ind.	10-12	blk, red, brn	—	1+5	daisy wh'l
DATA TERM'LS	382	—	RP	1	3750.	158	55CPS	Std.	10-12	blk, red, brn	—	1+5	daisy wh'l
DATA TEST	300	Line Printer	RP	2	5595.	132	300LPM	10	10	—	—	1+5	belt
DATA TEST	300	Line Printer	RP	2	4495	80	300LPM	10	10	—	—	1+5	belt
DATEL SYSTEMS	AIP-40	—	—	—	—	40	50CPS	5	5	—	—	no	thermal
DATEL SYSTEMS	DPP-07	—	—	—	—	7	4LPS	6	12	—	—	no	serial matrix
DECISION DATA	3240	—	—	—	—	132	120CPS	6	10	—	—	—	serial matrix
DIABLO	2300	—	—	—	2300.	132	200CPS	—	—	—	—	1+5	—
DIABLO	1345	—	—	—	1900.	132	45CPS	—	—	—	—	1+6	daisy wh'l
DIABLO	1355	—	—	—	2100.	132	55CPS	—	—	—	—	1+6	daisy wh'l
DI/AN CONTROL	model60/120	—	DS	1	1990	132	60-120	.1"	10	—	no	1+11	serial matrix

Printer Particulars

Company Name	Catalogue Number	Printer Name	Available From	Availability	Price	No. of Printing Columns	Max. Speed	Max. Li./In. (H)	Char./In. (W)	Ink Colors Available	Graphics Capability?	Multiple Copies?	Printer Mechanism
DI/AN CONTROL	model 60/120	--	DS	1	2990.	132	CPS	.1"	10	--	no	1 + 11	serial matrix
DIG'L EQ. CORP.	LA180	DECprinter	--	--	3085.	132	180CPS	--	--	--	--	1 + 5	serial matrix
DEC	PT96		RT,MO	2	675. Kit	132	120CPS	.11"	25	blk	no	1 + 3	serial matrix
DOCUMENTAT'N	PT96	Comp Printr	RT,MO	2	795. Asm	132	120CPS	.11"	25	blk	no	1 + 3	serial matrix
DOCUMENTAT'N	DOC2000	--	--	--	--	132, 150	2000LPM	.133 in/ch	6-8	--	--	1 + 5	band
EDITYPER SYS.		Edityper	RT,MO	1	395.	156	15CPS	6	10or12	--	no	yes	spherical
EDITYPER SYS.		Edityper	MO	1	795.	156	15CPS	6	10or12	--	no	yes	spherical
EXPANDOR	model 123-P	Blk Box Prntr	RT,MO	3	426.	80	10CPS	.107"	10.8	any colr rib'n	no	1 + 3	cylinder
EXTEL	B308SWL	--	--	--		80		4.4	11or10	--	--	1 + 2	serial matrix
EXTEL	B3055	--	--	--		80		4.4	11or10	--	no	1 + 2	serial matrix
EXTEL	B305STL	--	--	--	--	69	30CPS		4.4 +	--	--	1 + 2	serial matrix
EXTEL	B208L	--	--	--	--	80	30CPS		6. +	--	--	1 + 2	serial matrix
EXTEL	AH	--	--	--	--	80	30CPS		6. +	--	--	1 + 2	serial matrix
FACIT-ADDO	4506	Serial	DS,	1	3200.	155	250CPS	6	10	--	yes	yes	serial matrix
FACIT-ADDO	4540	Matrix Pr.	RP	1	4000.	155	250CPS	6	10	--	yes	yes	serial matrix
FLORIDA DATA	PB-600	--	--	--	--	132	600CPS	6	10	--	--	1 + 5	serial matrix
GULTON	NP-7	--	RP	2	459.	7	4LPS	6	.11"	--	yes	no	thermal
GULTON IND.	ANP-9	--	RP	2	540.	9	2.5LPS	.11"	6	--	yes	no	thermal
GULTON IND.	AP-20	--	RP	2	675.	9	2.5LPS	.11"	6	--	yes	no	thermal
HEWLETT-PACKARD	HP2631A	--	--	--	--	227	180CPS	1-12	16.7	--	--	1 + 5	serial matrix
	HP2635A	--	--	--	--	227	180CPS	1-12	16.7	--	--	1 + 5	serial matrix
HONEYWELL	1131 (RO)	--	--	--	--	132	30CPS	--	--	--	--	1 + 4	--
HONEYWELL	1133	--	--	--	--	132	120CPS	--	--	--	--	1 + 4	--
HOUSTON INSTRUM'NT	8210	8200 series	RP	1	3450.	80	2400LPM	10	6	blk	no	no	electrostatic
	8230	8200 ser L.P.	RP	1	3785.	132	1400LPM	10	6	blk	no	no	electrostatic
HYCOM	4004A												
HYCOM	DC21950												
HYCOM	DC21206												
HYCOM	CE-16AP	--	--	--	--		360LPM	10	5	--	--	no	electronic disch.
HYCOM	CE-21AP	--	--	--	--	80	360LPM	10	10.5	--	--	no	electronic disch.
HYDRA	B	--	--	--	--	136	180CPS	--	--	--	--	1 + 5	--
INTEGRAL DATA SYSTEMS	IP-125	Friction Fd. Impact Pr.	RT,MO, DS	2	799.	132	80CPS	.11"	8.3-16.5	blk	yes	yes	serial matrix
INTEGRAL DATA SYSTEMS	IP-225	Tractor Fd Impact Pr.	RT,MO DS	2	799.	132	80CPS	.11	8.3-	blk	yes	yes	serial matrix
INTERTEC	--	Superterm	--	--	1995.	132	200CPS	--	--	--	--	--	serial matrix
C.ITOH ELEC.	512,522,542	--	--	--	--	36	3 LPS	--	--	--	--	--	serial matrix
C.ITOH ELEC.	EP101+	--	--	--	--	18-21	2.8LPS	--	--	--	--	--	drum
LOGABAX	LX80	--	--	--	--	132	180CPS	6	10-16.5	--	--	1 + 4	serial matrix
LOGABAX	LX180	--	--	--	--	132	180CPS	6	10-16.5	--	--	1 + 4	serial matrix
LOGABAX	LX360	--	--	--	--	162	140LPM	6	10-12	--	--	1 + 4	serial matrix
MALIBU DESIGN GROUP	No. 160	Line Printer	RT,MO DS,RP	2	1995	132	165CPS	.098"	10	blk	yes	yes	serial matrix
MI^2 CORP.	2400	--	--	--	--	137, 158	180CPS	6	10or12	--	--	1 + 4	serial matrix
MICROCOM SYSTEMS	CP-40	Line Impact	--	--	375.	40	75LPM	--	--	--	--	--	--
	CP-64	Printer	--	--	425.	60	75LPM	--	--	--	--	--	--
MICROCOMPUT'R DEVICES	9710	Selectra-term	RT, MO	2	1750.	155	14CPS	6	10or12	All avail IBM colors	no	yes	spherical convrtd. IBM selectric II
MICRODATA CORP.	--	Matrix	--	--	1755.	132	120CPS	6	10	--	--	1 + 5	serial matrix
MILTOPE CORP.	LP3036	--	--	--	--	60	300LPM	--	--	--	--	yes	-- (military)
MILTOPE CORP.	HSP3609-80	--	--	--	--	80	400LPM	--	--	--	--	1 + 4	-- (military)
MILTOPE CORP.	HSP3609 212A	--	--	--	--	80	360LPM			--	--	1 + 3	serial matrix
MPI	--	Impact Dot Matrix Prntr	--	--	425.	40	--	--	--	--	--	--	serial matrix

Printer Particulars

Company Name	Catalogue Number	Printer Name	Available From	Availability	Price	No. of Printing Columns	Max. Speed	Max. Li./In. (H)	Char./In. (W)	Ink Colors Available	Graphics Capability?	Multiple Copies?	Printer Mechanism
NIPPON ELEC.	NH3000	—	—	—	2365.	132	180CPS	—	—	—	—	1+4	—
NIPPON ELEC.	NB3000	—	—	—	1960.	132	40CPS	—	—	—	—	1+7	—
OKIDATA CORP.	CP210	—	—	—	—	96	120CPS	5-6	12	—	—	1+3	serial matrix
OKIDATA CORP.	CP110	—	—	—	—	80	110CPS	6 or 3	10	—	—	1+3	matrix
OKIDATA CORP.	22	—	—	—	—	132	125LPM		10	—	—	1+5	matrix
OLIVETTI	P6060	Personl Computer w/ intgrtd prntr	—	—	8950.	80	80CPS	—	—	—	yes	—	thermal serial matrix
OLIVETTI	TC480	—	—	—	—	132	30CPS	6	10	—	—	1+2	serial matrix
PERIPHERAL VISION	—	Impact Prntr	MF,MF		540.K 695.A	96	120CPS	6	12	—	—	1+3	serial matrix
PERKIN-ELMER DATA SYSTMS	model 650,T50-300	Pussycat CRT Page Printer	RT	1	1262.	80;60	1920CPS	3/16"	9	B on W or W on B	yes	no	thermal matrix
PERKIN-ELMER	Carousel 300	—	—	—	—	132	30CPS	6	10	—	—	1+5	"spherical" element
PERKIN-ELMER	Carousel 310	—	—	—	—	132,	40CPS	6	10-12.5	—	—	1+11	"spherical" element
PERKIN-ELMER	Carousel 350	—	—	—	—	165	37.5CPS	6	10-12.5	—	—	1+11	"spherical" element
PRACTICAL AUTOMATION	DMTP3	—	—	—	—	132	100CPS	6	10	—	—	1+5	serial matrix
PRACTICAL AUTOMATION	DMTP-5	—	—	—	—	25	100CPS	—	3-12	—	—	1+2	serial matrix
PRACTICAL AUTOMATION	DMTP-6	—	—	—	—	96	120CPS	6	8-16.5	—	—	1+3	serial matrix
PRINTEC CO.	100	—	—	—	—	132	70 CPS	6	10	—	—	1+5	drum
PRINTEC CO.	100A	—	—	—	—	132	35CPS	6	10	—	—	1+5	drum
PRINTEC CO.	100M	—	—	—	—	132	150LPM	6	10	—	—	1+1	drum
PRINTRONIX	150	—	—	—	—	132	150LPM	6	10	—	—		
PRINTRONIX	300					132	500LPM	6	10				
POTTER INSTRU	LP6351	—	—	—	—	176		8	13.3	—	—	1+5	serial matrix
QUALTERM TERMINALS	QTP-45	Qualterm Port'ble Term	RT, DS		4645.	136/ 158	45CPS	—	10/12	—	yes	no	daisy wh'l
QUME CORP.	—	Sprint 5	DS	3	2950.	132	45CPS			blu,blk,red	yes	yes	daisy wh'l
		Sprint 5	RP	3	3300.	158	55CPS	V	10-15	grn,brwn	yes	yes	daisy wh'l
RONDURE	—	Beta	RT,MO	1	450.	132	10,15CPS	6	10	black	no	ye	wheel
RONDURE	—	ASCII Selectric Printer	RT,MO	1	925.	132	15CPS	6	10	any IBM colors	no	yes	spherical element
RONDURE	—	Port. Mite unit	RT,MO	1	400.	80	10CPS	—	—	black	no	yes	cylinder
SELECTERM	75/5,1	—											serial matrix
SCI SYSTEMS	model 110	Rotary Prntr	RP	1	243.	136	2200CPS	10PT	10	blk	yes	no	serial matrix
SIEMENS CORP. Sheldon-Sodeco (Landis-Gyr) SOUTHWEST TECH. PROD.	series PR	15+21 column Alphanumeric Printer	RP	1	120.	21	90LPM	.0093"		blk+rd,purp+rd,blk,purpl.	no	yes	drum matrix
TALLY CORP.	T1200	—	—	—	—	132	120CPS	—	—	—	—	1+5	—
TALLY CORP.	T1202	—	—	—	—	132	120CPS	—	—	—	—	1+5	—
TALLY CORP.	T1602	—	—	—	—	132	160CPS	—	—	—	—	1+5	—
TELETYPE CORP.	43	—	—	—	1299.	132	45CPS	—	—	—	—	1+2	—
TELPAR	PS-48-O	—	RT,MO DS, RP	1	666.	48	24CPS	.1"	10	blu or blk	no	no	thermal
TEXAS INSTRU.	810	—	—	—	—	132	30CPS	—	—	—	—	1+2	
TRIFORMATION SYSTEMS	ISE-1	—	RP	2	2900.	40	10CPS	—	—	(Braille)	no	no	braille cell
	BD-3	—	MF	2	1850.	40	10CPS	—	—	(Braille)	no	no	braille cell
UNITED SYS. TECH'Y	6300 series	Alphanumeric PR.	RP	1		26	2LPS	23mm	—	blk	no	no	electrostatic serial matrix
VICTOR COMPTOM'R	5500	Data Terminal	RP,MF	3	1076.	34	240LPM	.105"	10	red 7 blue	no	yes	serial matrix
WORLDWIDE ELECTRONICS	—	Used IBM Selec. I/O Terminal	RT	—	695.	—	—	6	10	all IBM colrs	no	yes	spherical

Manufacturers Reference Guide

AGILE INC.
1050 Stewart Dr.
Sunnyvale, CA 94086

ALANTHUS DATA COMM.
20030 Century Blvd.
Germantown, MD 20767

ANADEX
9825 DeSoto Ave.
Chatsworth, CA 91311

ANDERSON JACOBSON
621 Charcot Ave.
San Jose, CA 95151

APPLE COMPUTER
20863 Stevens Creek Blvd.
Cupertino, CA 94014

APPLIED COMPUTER SYSTEMS
248 Sovante Way
Sunnyvale, CA 94086

APPLIED COMPUTING TECH.
17961 E. Sky Park Circle
Irvine, CA 92707

AXIOM CORP.
5932 San Fernando Rd.
Glendale, CA 91202

CALIFORNIA BUSINESS MACHINES
2211 The Alameda
Santa Clara, CA 95050

CENTRONICS
One Wall St.
Hudson, NH 03051

COMDATA
8115 N. Monticello Ave.
Skokie, IL 60076

COMMODORE
901 California Ave.
Palo Alto, CA 94304

COMPUTER DEVICES INC.
9 Ray Ave.
Burlington, MA 01803

COMPUTER TERMINAL SYST. INC.
52 Newtown Plaza
Plainview, NY 11803

COMPUTER TRANSCEIVER SYS.
317 Route 17
Paramus, NJ 07652

COMPUTER USAGE SERV. INC.
Norcross, GA 30071

COMPUTER WAREHOUSE
584 Commonwealth Ave.
Boston, MA 02215

CONTROL DATA CORP.
1480 N. Rochester Rd.
Rochester, NY 48063

DATA ACCESS SYSTEMS INC.
00 Route 46
Mountain Lake, NJ 07046

DATADYNE CORP.
Box 247
King of Prussia, PA 19406

DATA GENERAL
Route 9
Westboro, MA 01581

DATAPRODUCTS
6219 DeSoto Ave.
Woodland Hills, CA 91369

DATAROYAL INC.
235 Main Dunstable Rd.
Nashua, NH 03060

DATA + TECHNIK CORP.
24 Avon Circle
Needham Heights, MA 02194

DATA TERMINALS & COMM.
190 Dell Ave.
Campbell, CA 95008

DATA TEST CORP.
2450 Whitman Rd.
Concord, CA 94518

DATEL SYSTEMS INC.
1020 Turnpike St.
Canton, MA 02021

DECISION DATA CORP.
100 Witmer Rd.
Horsham, PA 10044

DIABLO SYSTEMS INC.
24500 Industrial Blvd.
Hayward, CA 94545

DIAMOND ENGINEERING
3635 150th NE
Redmond, WA 98052

DI/AN CONTROLS INC.
944 Dorchester Ave.
Boston, MA 02125

DIGITAL COMPUTER CONTROLS
12 Industrial Rd.
Fairfield, NJ 07006

DIGITAL EQUIPMENT CORP.
1 Iron Way
Marlboro, MA 01752

DIGITAL GROUP
P. O. Box 6528
Denver, CO 80206

DIGITEC (UNITED SYSTEMS)
P. O. Box 458
Dayton, OH 45401

DOCUMATION, INC.
P.O. Box 1240
Melbourne, FL 32901

EDITYPER SYSTEMS
26 Just Rd.
Fairfield, JN 07006

ELECTRONIC PRODUCTS ASSOC.
1157 Vega St.
San Diego, CA 92110

EPSON
23844 Hawthorne Blvd.
Torrance, CA 90505

EXPANDOR INC.
612 Beatty Rd.
Monroeville, PA 15146

EXTEL CORP.
310 Anthony Corp.
Northbrook, IL 60062

FACIT-ADDO, INC.
66 Field Point
Greenwich, CT 06830

FLORIDA DATA CORP.
8308 New Haven Ave.
West Melbourne, FL 32901

H. DELL FOSTER
14703 Jones Maltberger Road
San Antonio, TX 78216

GENERAL ELECTRIC DATA
GE Drive
Waynesboro, VA 22980

GENESIS ONE COMPUTER CORP.
800 East 44th St.
New York, NY 10017

GULTON INDUSTRIES INC.
(M.C.S. DIVISION)
Gulton Industrial Park
East Greenwich, RI 02818

HARRIS DATA COMM.
Daniel Webster Hiway S.
Nashua, NH 03061

HEATH CO.
Benton Harbor, MI 49022

HECON CORP.
31-45 Park Rd.
Hinton Falls, NJ 07724

HEWLETT-PACKARD CO.
1501 Page Mill Rd.
Palo Alto, CA 94804

HOUSTON INSTRUMENT
8500 Cameron Rd.
Austin, TX 78753

HYCOM INC.
16841 Armstrong Ave.
Irvine, CA 92714

IMSAI MANUFACTURING CO.
14860 Wicks Blvd.
San Leandro, CA 94577

INFOREX
21 North Ave.
Burlington, MA 01803

INTEGRAL DATA SYSTEMS
5 Bridge St.
Watertown, MA 02172

INTERDATA
1 Ocean Place
Oceanport, NJ 07757

INTERTEC DATA SYSTEMS
1851 Interstate 85 So.
Charlotte, NC 28208

C. ITOH ELECTRONICS INC.
5301 Beethoven St.
Los Angeles, CA 90066

JUKI MACHINERY
8186-G Airway Ave.
Costa Mesa, CA 92626

LEAR-SIEGLER, INC.
714 N. Brookhurst Street
Anaheim, CA 92803

LITTON DATALOG
1770 Walt Whitman Rd.
Melville, NY 11746

LOGABAX IND.
10889 Wilshire Blvd.
Los Angeles, CA 90024

LOGICON/INTERCOMP.
24225 Garnier St.
Torrance, CA 90505

MACRO PRODUCTS
3110 Willow St.
Long Beach, CA 90806

MALIBU DESIGN GROUP INC.
21110 Nordhoff St.
Chatsworth, CA 91311

MASTER DIGITAL CORP.
1308-F Logan Ave.
Costa Mesa, CA 92626

MEDIA 111
2259 Via Burton
Anaheim, CA 92806

MESA, INC.
11900 Parklawn Dr.
Rockville, MD 20852

MFE CORP.
Keewaydin Dr.
Salem, NH 03079

MICROCOMPUTER DEVICES
960 Orangethorpe Bldg.
Anaheim, CA 92801

MICRODATA CORP.
17481 Red Hill Ave.
Irvine, CA 92714

MICROMATION
524 Union St.
San Francisco, CA 94133

MILLTYPE CORP.
151 Sunnyside Blvd.
Plainview, NY 11803

MITSUI AND CO. INC.
200 Park Ave.
New York, NY 10017

MSI
220 West Cedar
Olathe, KS 66061

NCE/COMPUMART
1250 North Main Street
Ann Arbor, MI 48107

NCR CORP.
EDP Products
Dayton, OH 45409

NIPPON ELECTRIC CO.
5 Militia Dr.
Lexington, MA 02173

OKIDATA CORP.
111 Gaither Dr.
Moorestown, NJ 0805

OLIVETTI
500 Park Ave.
New York, NY 10022

OPTRONICS INTERNATIONAL
7 Stuart Rd.
Chelmsford, MA 01824

PERIPHERAL VISION
3248 S. Eudora
Denver, CO 80222

PERKIN-ELMER DATA SYS
Route 10 and Emery Ave.
Randolph, NJ 17801

PERTEC/MITS
2450 Alamo S.E.
Albuquerque, NM 87106

PRACTICAL AUTOMATION INC.
Trap Falls Rd.
Shelton, CT 06484

THE PRINTER SALES CO.
3110 Willow St.
Long Beach, CA 90806

PRINTRONIX CORP.
17421 Derian Ave.
Irvine, CA 92714

POTTER INSTRUMENT CO. INC.
51 Sunnyside Blvd.
Plainview, NY 11803

QUALTERM TERMINALS
2005 O'Toole Ave.
San Jose, CA 95131

QUME CORP.
2323 Industrial Park
Hayward, CA 94545

RANDAL DATA SYSTEMS
2807-F Oregon Court
Torrance, CA 90503

RCA SERVICE CO.
Bldg. 204-2
Camden, NJ 08101
Att: Mr. J. Donahue

RICOH OF AMERICA INC.
7 Kingsbridge Rd.
Fairfield, NJ 07006

RONDURE CO.
2522 Butler Street
Dallas, TX 75235

SCM/KLEINSCHMIDT
Lake Cook Rd.
Deerfield, IL 60015

SCOPE DATA INC.
3728 Silver Star Rd.
Orlando, FL 32808

SELECTERM INC.
2 Audubon Rd.
Wakefield, MA 02143

SIEMENS CORP.
P. O. Box 5006
Cherry Hill, NJ 08034

SODECO (LANDIS & GYR)
4 Westchester Plaza
Elmsford, NY 10529

SOUTHERN SYSTEMS INC.
3000 N.E. 30 Place
Ft. Lauderdale, FL 3330

SOUTHWESTERN SYST. SERVICES
6116 Skyline No. 110
Houston, TX 77057

SOUTHWEST TECH. PROD. CORP.
219 Rhapsody
San Antonio, TX 78216

SWEDA INTERNATIONAL
34 Maple Ave.
Pine Brook, NJ 07058

SYCOR INC.
100 Phoenix Dr.
Ann Arbor, MI 48104

TALLY CORP.
8301 South 180th St.
Kent, WA 98031

TELESPEED COMMUNICATIONS
40 Underhill Blvd.
Syosset, NY 11791

TELETYPE CORP.
5555 Touchy Ave.
Skokie, IL 60076

TELETYPEWRITER COMM. SPEC.
550 Springfield Avenue
Berkeley Heights, NJ 07922

TELEX TERMINAL COMM.
P. O. Box 27288
Raleigh, NC 27611

TELPAR, INC.
4132 Billy Mitchell Rd.
Box 796
Addison, TX 75001

TEXAS INSTRUMENTS
P. O. Box 5012 M/S 84
Dallas, TX 75222

TL INDUSTRIES
6061 Telegraph Rd.
Toledo, OH 43612

TRENDATA COMPUTER SYS.
610 Palomar Ave.
Sunnyvale, CA 94086

TRIFORMATION SYSTEMS
P. O. Box 2433
Stuart, FL 33494

TRI-STAR COMPUTER SYS.
304 Harper Dr.
Moorestown, NJ 08057

TYPETRONIC COMPUTER STORE
806 Route 17
Ramsey, NJ 07446

UNIVAC DIV.
Sperry Rand Corp.
P. O. Box 500
Blue Bell, PA 19422

VARIAN DATA MACHINES
611 Hansen Way
Palo Alto, CA 94303

VECTOR GRAPHIC
790 Hampshire Rd. A&B
Westlake Village, CA 91361

VERSATEC INC.
2805 Bowers Ave.
Santa Clara, CA 95051

VICTOR COMPTOMETER CORP.
3900 North Rockwell St.
Chicago, IL 60618

VOGUE INSTRUMENT CORP.
131st St. at Jamaica Ave.
Richmond Hill, NY 11418

WANG LABORATORIES
836 North St.
Tewksbury, MA 01876

WESTERN UNION DATA SERVICE
70 McKee Dr.
Mahwah, NJ 07430

XEROX CORP.
701 S. Aviation Blvd.
El Segundo, CA 90245

ZENTEC CORP.
2390 Walsh Ave.
Santa Clara, CA 95050

Dot by Dot

BY FRED HELLIWELL

Remember the game of Initials you played when you were younger? Maybe you called it Dots. But you drew a matrix of *m* by *n* dots. Then you and your opponent took turns connecting the dots; if you completed a box, you put your initials in the box and took another turn. At the end of the game, the person with the most boxes won.

On vacation last fall, I saw a 9-dot version of Initials discussed in the September/October 1977 *Personal Computing*. Since I had plenty of time, I boasted to my visiting brother that I could write a program so the first player would always win. At the time, I had no idea how to go about it, but I was determined. (Younger brothers must never be lied to.)

From my long-passed school days I dredged up a few general rules for solving difficult problems:

1) Chop the problem into manageable chunks.

2) Work on the chunks both backwards and forwards.

3) With no idea of where to go, start off in any direction. If you run into a dead end, go back.

4) If you stumble onto something interesting, experiment.

For starters I wrote a BASIC program for my Apple computer so that two players can play against each other. I added a few extras like printouts telling of invalid or duplicate moves and a list of all moves to date. The game is displayed on a TV screen with a colored corner square to indicate who moves next.

All I need now is to expand the program so the computer can play against an opponent and always win. Let's begin.

To play the game, players alternate drawing vertical and horizontal bars between dots on a 3 x 3 matrix. A sample first move is shown in Figure 1.

To keep track of which bars have been drawn, let's number the possible bars as shown in Figure 2. Horizontal bars are numbered 81 through 86 and vertical bars 91 through 96.

Look at the sample game, in progress, in Figure 3. When a player completes a small box of four bars, he puts his initials in the box and takes another turn. When all 12 bars have been drawn, the winner is the player who completed the most squares – that is, the one with the most initialed boxes.

For convenience, we can label the small boxes QA, QB, QC and QD, as shown in Figure 4.

Let's call the first player Green and the second player Purple. Green always moves first; to win, he must initial 3 or 4 squares.

If, as in Figure 5, Green plays 82 on his first move, Purple counters with 85. From then on, Purple need only copy each of Green's moves on the opposite side of 82-85 until a move giving Purple two initialed squares becomes obvious. (The dotted lines, Figure 5, show an example.) Purple has limited Green to initialing only two squares so Green cannot win.

We now get to the meat of the problem.

Green's No. 1 Strategy. In the early moves of the game, Green must avoid placing an inside bar when it can be immediately followed by a Purple

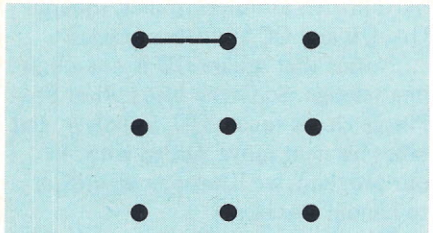


Figure 1

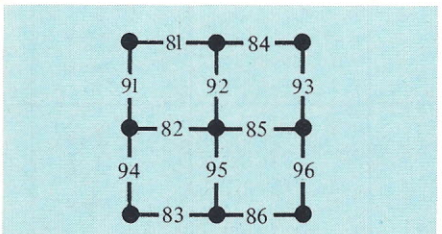


Figure 2

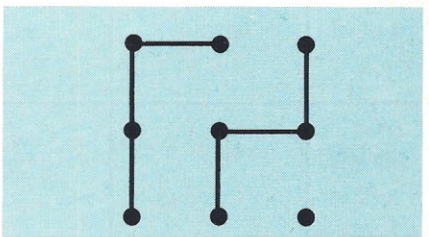


Figure 3

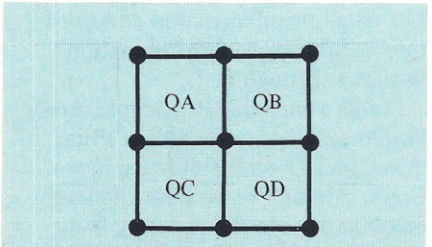


Figure 4

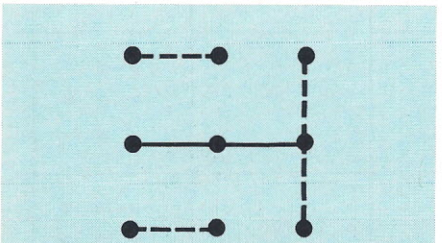


Figure 5

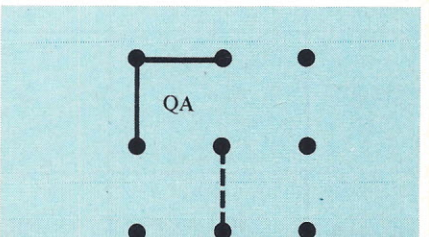


Figure 6

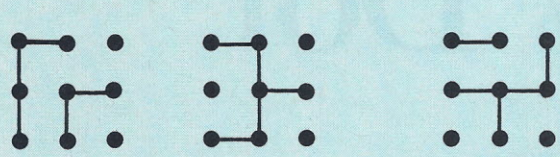


Fig 7 Magic Fives

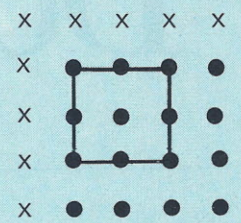


Fig 8 The 16-dot and 25-dot games

move dividing the game into two equal parts, one part for Green and one part for Purple.

Green always plays 81 on his first move. Should you play this game with a friend, you'll find No. 1 strategy easy to apply in many cases.

In Figure 6, Purple has played 91. Green can safely play 95 as shown by the dotted line. Now, if Purple plays 92, Green can complete the square QA and be well on the way to winning the game.

Some moves will not be so obvious. Like a chess player we should think a few moves ahead. More about early moves later.

One rainy day, with about 100 game diagrams in front of me, I noticed a number of game diagrams that had exactly five bars which, when completed, would result in a sure win for Green. I called them magic fives. None had a box with more than two bars in place. (See Figure 7 for examples.)

I realized there couldn't be a large number of magic fives. I methodically made a list, in diagram form, of partial games having exactly five bars in place and no square with more than two bars. I stopped when I had 148 of them. Examining each, I discovered 77 magic fives.

Green's No. 2 Strategy. After the seventh move, Green places no inside bars unless placing the fourth bar in a square.

Green's No. 3 Strategy. After the fifth move, Green looks for a square that has fewer than two bars in place and puts an outside bar on it. This strategy always applies except for a few special cases discussed later.

Green's No. 4 Strategy. When all squares have two or more sides and Green *must* place a bar which will allow Purple to complete a square, he looks for sausages. Refer to Figure 3. Square QA and square QB form a sausage. If Green plays 84, 82 or 92, Purple then closes one square and with his next free move, closes another. In fact, squares QA, QB and QC all form sausages.

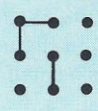
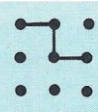
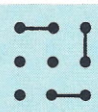
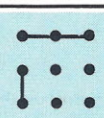
Notice that square QD is not a link in a sausage. So Green plays 96 or 86. Purple closes square QD, initials it, and takes his next move. Green wins. In our program, we'll have an algorithm to handle sausages.

Now, back to the beginning. In Figure 1, notice that Purple has exactly eleven possible moves. With the magic five list and the No. 1 Strategy in mind, I listed all possible second and third moves, labeling each combination Games 1 through 6.

Table 1 includes all possible moves Purple can make after Green's first move, plus Green's following move. Green cannot lose because all eleven combinations lead to a magic five.

I then made a list of all possible fourth moves by Purple. Referring again

Table 1

	MOVE 1 (GREEN)	MOVE 2 (PURPLE)	MOVE 3 (GREEN)	RESULT
GAME 1	81	91 95	95 91	
GAME 2	81	85 92	92 85	
GAME 3	81	86 93	93 86	
GAME 4	81	84 94	94 84	
GAME 5	81	82	93	
GAME 6	81	83 96	96 83	

to the magic five list, I selected a responding fifth move by Green. (You can make a table of these moves for yourself.) A short algorithm handles moves after the fifth move.

However, there are five special cases in which there are no inside bars after the fifth move. (There would be more of these cases if we counted reflections and rotations.) Treating these special cases individually as shown in Table 2 makes our program shorter.

We now have sufficient information to complete the program (see Program Listing).

If we analyzed the Initials game further, we could discover all possible

At the time, I had no idea how to go about it but I was determined. I boasted to my brother that I could write a program so the first player would always win.

magic fives and then all possible winning third moves. A computer program could be written to print that information.

Armed with all possible winning moves, we could attack the 16-dot game as shown in Figure 8.

Imagine our 9-dot game superimposed on the 16-dot grid. If Purple moves beyond the solid lines, so does Green, maintaining Green's advantage at least, so I surmise. The same can be said for the 25-dot game as shown by the x's.

In the 9-dot game, try introducing a random bar as a programmed option on the computer's fifth move. This feature would result in some "non-magic fives", giving the human a chance to beat the computer. To do this, change the introductory text and add the option at statement 540. □

(program on following page)

Table 2

RESULT AFTER MOVE 5 (GREEN)	MOVE 6 (PURPLE)	MOVE 7 (GREEN)	RESULT
	95 84	84 95	
	96	95	
	85 83	83 85	
	84 95	95 84	
	96	95	
	85 94	94 85	
	83 85	85 83	
	93 95	95 93	
	96	95	
	91 85	85 91	
	93	95	
	86	92	
	91	95	
	82	86	

Program Listing

```
0 DIM MV(14)
1 TEXT : CALL -936: GOSUB 890

2 GR : PRINT : PRINT :QA=0:QB=
  0:QC=0:QD=0
5 T=0:M=0:S=0:SQ=0:QA=0:QB=0:
  QC=0:QD=0:QE=0:QF=0:QG=0:QH=
  0:QI=0:QK=0:QL=0
6 QM=0:QN=0:QO=0:QP=0:QR=0:QS=
  0:QT=0
7 MV(1)=0:MV(2)=0:MV(3)=0:MV(
  4)=0:MV(5)=0:MV(6)=0:MV(7)=
  0:MV(8)=0:MV(9)=0:MV(10)=0:
  MV(11)=0
8 MV(12)=0:GM=0
9 AX=0:BX=0:CX=0:DX=0
10 Q=0
11 NT=0:QA1=0:QA2=0:QA3=0:QA4=
  0:QB1=0:QB2=0:QB3=0:QB4=0:QC1=
  0:QC2=0:QC3=0:QC4=0:QD1=0:QD2=
  0:QD3=0:QD4=0
20 COLOR=7: FOR K=0 TO 39: HLIN
  0,39 AT K: NEXT K
29 COLOR=0
30 HLIN 3,4 AT 3: HLIN 3,4 AT
  4: HLIN 19,20 AT 3: HLIN 19
  ,20 AT 4
31 HLIN 35,36 AT 3: HLIN 35,36
  AT 4: HLIN 3,4 AT 19: HLIN
  3,4 AT 20
32 HLIN 19,20 AT 19: HLIN 19,20
  AT 20: HLIN 35,36 AT 19: HLIN
  35,36 AT 20
33 HLIN 3,4 AT 35: HLIN 3,4 AT
  36: HLIN 19,20 AT 35: HLIN
  19,20 AT 36
34 HLIN 35,36 AT 35: HLIN 35,36
  AT 36
40 IF M=0 THEN COLOR=12: IF M=
  1 THEN COLOR=3: HLIN 0,1 AT
  0: HLIN 0,1 AT 1
43 IF P$="A" AND M=0 THEN 500
49 IF S=0 THEN 50: GOTO 103
50 COLOR=1: PRINT : PRINT "HORIZONT
  AL BAR-TYPE 81 TO 86": INPUT
  "OR VERTICAL BAR TYPE 91 TO 96",T
53 IF T=0 THEN 1
69 GOTO 120
70 IF T=81 THEN HLIN 5,18 AT 3
  : IF T=81 THEN HLIN 5,18 AT
  4: IF T=81 THEN QA3=1
71 IF T=81 THEN 300
72 IF T=82 THEN HLIN 5,18 AT 19
  : IF T=82 THEN HLIN 5,18 AT
  20: IF T=82 THEN QA2=1: IF
  T=82 THEN QC2=1
73 IF T=82 THEN 300
74 IF T=83 THEN HLIN 5,18 AT 35
  : IF T=83 THEN HLIN 5,18 AT
  36: IF T=83 THEN QC3=1
75 IF T=83 THEN 300
76 IF T=84 THEN HLIN 21,34 AT
  3: IF T=84 THEN HLIN 21,34 AT
  4: IF T=84 THEN QB3=1
77 IF T=84 THEN 300
78 IF T=85 THEN HLIN 21,34 AT
  19: IF T=85 THEN HLIN 21,34
  AT 20: IF T=85 THEN QB2=1:
  IF T=85 THEN QD2=1
79 IF T=85 THEN 300
80 IF T=86 THEN HLIN 21,34 AT
  35: IF T=86 THEN HLIN 21,34
  AT 36: IF T=86 THEN QD3=1
81 IF T=86 THEN 300
82 IF T=91 THEN VLIN 5,18 AT 3
  : IF T=91 THEN VLIN 5,18 AT
  4: IF T=91 THEN QA4=1
83 IF T=91 THEN 300
84 IF T=92 THEN VLIN 5,18 AT 19
  : IF T=92 THEN VLIN 5,18 AT
  20: IF T=92 THEN QA1=1: IF
  T=92 THEN QB1=1
85 IF T=92 THEN 300
86 IF T=93 THEN VLIN 5,18 AT 35
  : IF T=93 THEN VLIN 5,18 AT
  36: IF T=93 THEN QB4=1
87 IF T=93 THEN 300
88 IF T=94 THEN VLIN 21,34 AT
  3: IF T=94 THEN VLIN 21,34 AT
  4: IF T=94 THEN QC4=1
89 IF T=94 THEN 300
90 IF T=95 THEN VLIN 21,34 AT
  19: IF T=95 THEN VLIN 21,34
  AT 20: IF T=95 THEN QC1=1:
  IF T=95 THEN QD1=1
91 IF T=95 THEN 300
92 IF T=96 THEN VLIN 21,34 AT
  35: IF T=96 THEN VLIN 21,34
  AT 36: IF T=96 THEN QD4=1
93 IF T=96 THEN 300
94 PRINT "": PRINT "INVALID MOVE"
  : FOR I=1 TO 400: NEXT I: GOTO
  50
103 FOR Q=1 TO 12: PRINT MV(Q),
  : NEXT Q
```

Program Notes

0 - 11	Initial variables
20 - 34	Puts game board on CRT in colors
40	Player to move indicator
43	Branch for computer's move
53	Branch for a new game
70 - 93	Places a colored bar on the screen and records the fact that the bar is in place
103	Prints moves to date on the screen
105 - 115	Forces a three-sided square to be completed
120 - 131	Tests for duplciate moves
142	Goes for a proper move
300	Checks for a completed square. Adds 1 to move number. Stores the move
305	Changes the colored turn indicator
306 - 322	Checks for completed squares
323	Returns for the free move
325	Increments the turn flag
500 - 732	Computer decides on its move
503	Plays bar 81 on the first move
505	Tests for a completed game
515 - 536	Tests for three-bar squares. Adds the fourth completing bar and stores the results
542 - 555	Makes move 3. Strategy No. 1
562 - 624	Makes move 5
630 - 658	Plays Gm 7 to Gm 11 and makes move 7. Strategy No. 2 and 3
680 - 682	Counts the bars in the squares
683 - 686	Plays an outside bar on a square having fewer than two bars. Strategy No. 2 and 3
690 - 720	Sausage logic
730 - 732	Places a bar on a single link. Strategy No. 4
890 - 896	Introductory text
900 - 901	Prints the moves and goes for a new game

Program Variables

AX, BX, CX, DX	Flag for a complete square
GM	Game number
GR	Special Apple command for color
M	Flag for green or purple move
MV(S)	Stores bar number on each move number
NT	Game completed flag
Q	Flag for competed squares
QA, QB, QC, QD	Stores number of bars in the squares
QE - QT	Sausage logic
QA1 - QD4	Flags to indicate which bars are in place
S	Counts turns
SQ	Flags when a new square is complete
T	Current bar number

```
105 INPUT "NEXT MOVE",T: IF T=0
    THEN 1: COLOR=1: IF A0=3 THEN
    106: IF B0=3 THEN 107: IF D0=
    3 THEN 108: IF C0=3 THEN 109
    : GOTO 120
106 IF T=81 OR T=82 THEN 120: IF
    T=91 OR T=92 THEN 120: GOTO
    115
107 IF T=84 OR T=85 THEN 120: IF
    T=92 OR T=93 THEN 120: GOTO
    115
108 IF T=85 OR T=86 THEN 120: IF
    T=95 OR T=96 THEN 120: GOTO
    115
109 IF T=82 OR T=83 THEN 120: IF
    T=94 OR T=95 THEN 120: GOTO
    115
110 PRINT "INVALID MOVE": PRINT
    "": FOR I=1 TO 400: NEXT I:
    GOTO 40
115 PRINT "": PRINT "": PRINT ""
    : PRINT "COMPLETE SQUARES CLOCK-
    ISE FROM TOP LEFT": GOTO 105

120 FOR Q=1 TO 11: IF T=MV(Q) THEN
    140: NEXT Q
131 IF T>90 THEN 82: GOTO 70
140 REM ARK
142 PRINT "DUPLICATE MOVE   MOVE AGA
    INN": PRINT "": FOR I=1 TO
    400: NEXT I
143 GOTO 50
300 IF T=NT THEN 900:S=S+1:NT=T:
    MV(S)=T
305 IF M=0 THEN COLOR=12: IF M=
    1 THEN COLOR=3
306 S0=0
307 IF AX=1 THEN 310:A0=0A1+0A2+
    0A3+0A4: IF A0=4 THEN 308: GOTO
    310
308 HLIN 11,12 AT 11: HLIN 11,12
     AT 12:AX=1
309 S0=1
310 IF BX=1 THEN 315:B0=0B1+0B2+
    0B3+0B4: IF B0=4 THEN 311: GOTO
    315
311 HLIN 27,28 AT 11: HLIN 27,28
     AT 12:BX=1
312 S0=1
315 IF CX=1 THEN 320:C0=0C1+0C2+
    0C3+0C4: IF C0=4 THEN 316: GOTO
    320
316 HLIN 11,12 AT 27: HLIN 11,12
     AT 28:CX=1
317 S0=1
320 IF DX=1 THEN 323:D0=0D1+0D2+
    0D3+0D4: IF D0=4 THEN 321: GOTO
    323
321 HLIN 27,28 AT 27: HLIN 27,28
     AT 28:DX=1
322 S0=1
323 IF S0=0 THEN 325: GOTO 40
325 M=M+1: IF M=2 THEN M=0: GOTO
    40
500 COLOR=1: FOR I=1 TO 400: NEXT
    I
503 IF S=0 THEN T=81: IF S=0 THEN
    70
505 IF AX+BX+CX+DX=4 THEN 900
515 T=0
520 IF 0A1+0A2+0A3+0A4=3 THEN 521
    : GOTO 525
521 IF 0A1=0 THEN T=92: IF 0A2=
    0 THEN T=82: IF 0A4=0 THEN
    T=91: IF T#0 THEN 70
525 IF 0B1+0B2+0B3+0B4=3 THEN 526
    : GOTO 530
526 IF 0B1=0 THEN T=92: IF 0B2=
    0 THEN T=85: IF 0B3=0 THEN
    T=84: IF 0B4=0 THEN T=93: GOTO
    70
530 IF 0C1+0C2+0C3+0C4=3 THEN 531
    : GOTO 535
531 IF 0C1=0 THEN T=95: IF 0C2=
    0 THEN T=82: IF 0C3=0 THEN
    T=83: IF 0C4=0 THEN T=94: GOTO
    70
535 IF 0D1+0D2+0D3+0D4=3 THEN 536
    : GOTO 540
536 IF 0D1=0 THEN T=95: IF 0D2=
    0 THEN T=85: IF 0D3=0 THEN
    T=86: IF 0D4=0 THEN T=96: GOTO
    70
540 IF S>2 THEN 560
542 IF MV(2)=91 THEN T=95: IF MV(
    2)=95 THEN T=91: IF T=91 OR
    T=95 THEN GM=1: IF GM=1 THEN
    70
545 IF MV(2)=85 THEN T=92: IF MV(
    2)=92 THEN T=85: IF T=85 OR
    T=92 THEN GM=2: IF GM=2 THEN
    70
547 IF MV(2)=86 THEN T=93: IF MV(
    2)=93 THEN T=86: IF T=86 OR
    T=93 THEN GM=3: IF GM=3 THEN
    70
550 IF MV(2)=84 THEN T=94: IF MV(
    2)=94 THEN T=84: IF T=84 OR
    T=94 THEN GM=4: IF GM=4 THEN
    70
552 IF MV(2)=82 THEN T=93: IF T=
    93 THEN GM=5: IF GM=5 THEN
    70
555 IF MV(2)=83 THEN T=96: IF MV(
    2)=96 THEN T=83: IF T=83 OR
    T=96 THEN GM=6: IF GM=6 THEN
    70
560 IF GM>6 AND S<7 THEN 630: IF
    S>5 THEN 680
562 IF GM=6 THEN 620: IF GM=5 THEN
    610: IF GM=4 THEN 600: IF GM=
    3 THEN 590: IF GM=2 THEN 580

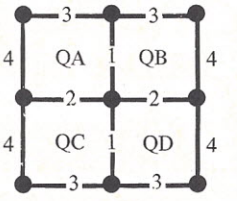
570 IF MV(4)=82 OR MV(4)=92 THEN
    T=84: IF T=84 THEN 70: IF MV(
    4)=85 THEN T=94: IF MV(4)=94
     THEN T=85: IF T=85 OR T=94
     THEN 70
571 IF MV(4)=84 THEN T=93: IF MV(
    4)=93 THEN T=84: IF T=84 OR
    T=93 THEN 70
572 IF MV(4)=96 THEN T=84: IF MV(
    4)=83 THEN T=85: IF T=85 OR
    T=84 THEN 70
573 T=93: GOTO 70
580 IF MV(4)=82 OR MV(4)=91 THEN
    T=83: IF MV(4)=84 OR MV(4)=
    93 THEN T=96: IF T=96 OR T=
    83 THEN 70
581 IF MV(4)=83 THEN T=95: IF MV(
    4)=95 THEN T=83: IF T=83 OR
    T=95 THEN 70
582 IF MV(4)=86 THEN T=94: IF MV(
    4)=94 THEN T=86: IF T=86 OR
    T=94 THEN 70
583 T=94: GOTO 70
590 IF MV(4)=91 THEN T=94: IF MV(
    4)=94 THEN T=91: IF T=91 OR
    T=94 THEN GM=7: IF GM=7 THEN
    70
593 IF MV(4)=83 THEN T=91: IF T=
    91 THEN GM=8: IF GM=8 THEN
    70
595 IF MV(4)=92 THEN T=96: IF MV(
    4)=96 THEN T=92: IF T=92 OR
    T=96 THEN 70
596 IF MV(4)=84 THEN T=95: IF MV(
    4)=95 THEN T=84: IF T=84 OR
    T=95 THEN 70
597 IF MV(4)=82 THEN T=96: IF T=
    96 THEN 70
598 T=91: GOTO 70
600 IF MV(4)=82 THEN T=93: IF MV(
    4)=93 THEN T=82: IF T=82 OR
    T=93 THEN 70
601 IF MV(4)=83 THEN T=92: IF MV(
    4)=92 THEN T=83: IF T=83 OR
    T=92 THEN 70
602 IF MV(4)=85 THEN T=95: IF MV(
    4)=95 THEN T=85: IF T=85 OR
    T=95 THEN 70
603 IF MV(4)=86 THEN T=91: IF MV(
    4)=91 THEN T=96: IF T=86 OR
    T=91 THEN GM=9: IF GM=9 THEN
    70
605 IF MV(4)=96 THEN T=83: IF T=
    83 THEN GM=10: IF GM=10 THEN
    70
610 IF MV(4)=85 THEN T=95: IF MV(
    4)=95 THEN T=85: IF T=85 OR
    T=95 THEN 70
611 IF MV(4)=84 THEN T=96: IF MV(
    4)=96 THEN T=84: IF T=84 OR
    T=96 THEN 70
612 IF MV(4)=91 OR MV(4)=92 THEN
    T=83: IF T=83 THEN 70
614 T=84: GOTO 70
620 IF MV(4)=82 THEN T=86: IF MV(
    4)=86 THEN T=82: IF T=82 OR
    T=86 THEN 70
621 IF MV(4)=94 THEN T=85: IF T=
    85 THEN 70
622 IF MV(4)=93 THEN T=85: IF T=
    85 THEN 70
623 IF MV(4)=91 THEN T=95: IF MV(
    4)=95 THEN T=91: IF T=91 OR
    T=95 THEN 70
624 IF MV(4)=84 THEN T=93: IF MV(
    4)=93 THEN T=84: IF T=84 OR
    T=93 THEN GM=11: IF GM=11 THEN
    70
630 IF GM=7 THEN 655: IF GM=8 THEN
    650: IF GM=9 THEN 645: IF GM=
    10 THEN 640
635 GM=6: IF MV(6)=91 THEN T=95
    : IF MV(6)=95 THEN T=91: IF
    T=91 OR T=95 THEN 70
636 IF MV(6)=82 THEN T=86: IF MV(
    6)=86 THEN T=82: IF T=82 OR
    T=86 THEN 70
637 GOTO 680
640 GM=4: IF MV(6)=91 THEN T=85
    : IF MV(6)=85 THEN T=91: IF
    T=85 OR T=91 THEN 70
641 IF MV(6)=92 THEN T=86: IF MV(
    6)=86 THEN T=92: IF T=92 OR
    T=86 THEN 70
642 IF MV(6)=93 THEN T=95: IF T=
    95 THEN 70
643 GOTO 680
645 GM=5: IF MV(6)=95 THEN T=93
    : IF MV(6)=93 THEN T=95: IF
    T=95 OR T=93 THEN 70
646 IF MV(6)=85 THEN T=83: IF MV(
    6)=83 THEN T=85: IF T=85 OR
    T=83 THEN 70
647 IF MV(6)=96 THEN T=95: IF T=
    95 THEN 70
648 GOTO 680
650 GM=3: IF MV(6)=84 THEN T=95
    : IF MV(6)=95 THEN T=84: IF
```

Program listing continued

```
    T=84 OR T=95 THEN 70
651 IF MV(6)=85 THEN T=94: IF MV(
    6)=94 THEN T=85: IF T=85 OR
    T=94 THEN 70
652 IF MV(6)=96 THEN T=95: IF T=
    95 THEN 70
653 GOTO 680
655 GM=3: IF MV(6)=84 THEN T=95
    : IF MV(6)=95 THEN T=84: IF
    T=84 OR T=95 THEN 70
656 IF MV(6)=83 THEN T=85: IF MV(
    6)=85 THEN T=83: IF T=83 OR
    T=85 THEN 70
657 IF MV(6)=96 THEN T=95: IF T=
    95 THEN 70
658 GOTO 680
680 QA=0:QB=0:QC=0:QD=0:QE=0:QF=
    0:QG=0:QH=0:QI=0:QJ=0:QK=0:
    QL=0:QM=0:QN=0:QO=0:QP=0:QR=
    0:QS=0:QT=0:QQ=0
682 QN=QA1+QA2+QA3+QA4:QE=QB1+QB2+
    QB3+QB4:QC=QC1+QC2+QC3+QC4:
    QD=QD1+QD2+QD3+QD4
683 T=0
684 IF QA=1 THEN T=91: IF QB<2 AND
    QB3=0 THEN T=84: IF QB<2 AND
    QD4=0 THEN T=93: IF QC<2 AND
    QC3=0 THEN T=83
685 IF QC<2 AND QC4=0 THEN T=94
    : IF QD<2 AND QD3=0 THEN T=
    86: IF QD<2 AND QD4=0 THEN
    T=96
686 IF T#0 THEN 70
690 IF QA=2 THEN QE=1: IF QB=2 THEN
    QF=1: IF QC=2 THEN QG=1: IF
    QD=2 THEN QH=1
700 IF QE=1 AND QF=1 THEN QI=1:
     IF QF=1 AND QH=1 THEN QJ=1
    : IF QG=1 AND QI=1 THEN QK=
    1: IF QG=1 AND QF=1 THEN QL=
    1
710 IF QI=1 AND QH=0 THEN QM=1
    : IF QJ=1 AND QG=0 THEN QM=
    1: IF QK=1 AND QH=0 THEN QO=
    1: IF QL=1 AND QG=0 THEN QP=
    1
720 IF QM=0 AND QP=0 THEN QQ=1:
     IF QN=0 AND QM=0 THEN QR=1
    : IF QO=0 AND QN=0 THEN QS=
    1: IF QP=0 AND QO=0 THEN QT=
    1
730 IF QQ=1 AND QR=0 THEN T=91
    : IF QR=1 AND QS=0 THEN T=
    84: IF QR=1 AND QE4=0 THEN
    T=93
731 IF QS=1 AND QD4=0 THEN T=96
    : IF QS=1 AND QD3=0 THEN T=
    86: IF QT=1 AND QC3=0 THEN
    T=83: IF QT=1 AND QC4=0 THEN
    T=94
732 IF T#0 THEN 70
890 TAB 12: VTAB 6: PRINT "# INITIAL
    S #": TAB 6: VTAB 14: PRINT
    "FIRST TO MOVE IS GREEN COLOR"

891 TAB 6: VTAB 16: PRINT "TWO PLAYE
    RS - TYPE P": TAB 6: VTAB 17
    : PRINT "YOU VS APPLE - TYPE A"

893 VTAB 19: PRINT "IF 3 SIDES IN TH
    EN COMPLETE THE SQUARE."
895 VTAB 20: INPUT P$
896 RETURN
900 FOR I=1 TO 12: PRINT MV(I);
    : NEXT I: INPUT "TYPE 0 FOR A NE
    W GAME ",T
901 IF T=0 THEN 2: GOTO 1
999 END
```



PS-48C Thermal Printer

The PS-48C is a state-of-the-art interactive printer designed to be used with all popular microcomputer systems. Mostek's F8/3870 single-chip microprocessor makes possible a versatile interface/controller that will operate in *any* of the following modes:

- **TTL parallel**
- **TTL serial**
- **RS232C serial**
- **20 mil loop serial**

Key features include:

- **Quiet, clean — no ribbons or ink**
- **Thermal paper now down to $3 per 164′ roll**
- **Throughput rate — 24 characters/second**
- **Upper/lower case 96 ASCII characters**
- **Signalling rates— Serial mode — 110 or 300 Baud Parallel mode — up to 960 characters/second**
- **For applications over 48 columns, automatically prints on next line**

telpar, inc.



PS-48C$666
KB-59 Teletype©/ typewriter keyboard$222
Paper roll 5-1/2″ x 164′$ 3

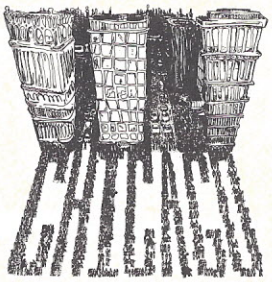
Printing mechanism with or without interface available on OEM basis.

Dealer inquiries wanted! Contact Dick Hanschen, (214) 233-6631.
4132 Billy Mitchell Road, Box 796, Addison, Texas 75001.

CIRCLE 12

The 2nd Annual

MIDWEST PERSONAL COMPUTING EXPOSITION



October 5, 6, 7, 8, 1978 • EXPOCENTER / Chicago (Adjacent to the Merchandise Mart)



A Larger Show in 1978 Because of Its Proven Value To Individual Computer Enthusiasts

They came in droves from all sectors of society for the first show last year — 12,565 to be exact. Doctors, lawyers, business persons, computer professionals, students and home users . . . proving the modern-day marvel of personal computing is within the grasp of everyone. And that was just for starters.

Now the Show That Captured the Fascination of the Entire Midwest Moves to a Larger Facility Permitting —

- An expected 200 exhibits showing the latest computer equipment, peripherals, accessories and software by America's leading manufacturers.
- An expanded seminar program of real value for anyone eager to learn new developments and the many innovative and practical applications of personal computing . . . delivered by industry professionals.
- Easy access from all public transportation and expressways with ample parking available.

It's the Most Complete and Diversified Exhibition of Personal Computing Technology Ever Staged for the Midwest Public . . . Plan Now to Participate as Visitor, Lecturer or Exhibitor

The ONLY Personal Computing Show in Chicago Officially Sponsored by PERSONAL COMPUTING Magazine

Organized in 1978 by:

Industrial and Scientific Conference Management, Inc. — a respected leader in expositions and conferences, worldwide

222 West Adams St., Chicago, IL 60606
(312) 263-4866

Return for Complete Information to:

MIDWEST PERSONAL COMPUTING EXPOSITION
c/o Industrial and Scientific Conference Management, Inc.
222 West Adams St., Chicago, IL 60606 • (312) 263-4866

☐ I am interested in ATTENDING. Please send registration information.

☐ I am interested in EXHIBITING. Please send contract and full details.

Name _____ Title _____

Company _____ Phone _____

Address _____

City _____ State _____ Zip _____

RELOCATABLE ROUTINES

BY ROBERT IRVING

If you've done significant amounts of programming in machine language, you'll be familiar with relocatable routines – series of program steps (subprograms, subroutines and so forth) which may be placed anywhere in a program without re-numbering the branch/jump instructions in the routine. Such routines save the programmer time, particularly if he uses a text editor which allows him to load the routine from tape, and then shift the line numbers of the routine to any sequence he desires before writing in the rest of the program. Relocatable routines are usually implemented by "relative address" techniques, generally limited to jumps of about plus-or-minus 126 steps from the current command.

Language levels higher than machine language usually don't provide for writing relocatable routines. In certain languages (for example, FORTRAN) in which statement numbers aren't always needed, a series of statements may be relocatable because there are no statement numbers in the entire routine. Loops in FORTRAN, however, aren't normally relocatable.

Programming systems which apply "structured" or

RELOCATABLE ROUTINE

```
N=__
DIM A(N)

FOR I=1 TO N
READ A(I)
NEXT I
D=I
D=2*D
J=INT(N/D)
IF J=0 THEN (+170)
L=1
H=J+1
IF H>N THEN (-50)
L1=L
H1=H
IF A(H)>=A(I) THEN (+80)
T=A(H)
A(H)=A(L)
A(L)=T
L=L-J
IF L<1 THEN (+30)
H=H-J
GOTO (-70)
L=L1 + 1
H=H1 + 1
GOTO (-130)
EXIT
```

Relocatable routine without line numbers. (Line numbers are added when inserted into program.)

SHELL SORT PROGRAM LISTING

```
10  N=100
20  DIM A(N)
– – – MANY STEPS OF MAIN PROGRAM – – –
1410  FOR I=1 TO N
1420  READ A(I)
1430  NEXT I
1440 D=I
1450  D=2*D
1460  J=INT (N/D)
1470 J=0 1640
1480  L=1
1490  H=J+1
1500  IF H>N THEN 1450
1510  L1=L
1520  H1=H
1530  IF A(H) > =  A(L) THEN 1610
1540  T=A(H)
1550  A(H)=A(L)
1560  A(L)=T
1570  L=L-J
1580  IF L<1 THEN 1610
1590  H=H-J
1600  GOTO 1530
1610  L=L1+1
1620  H=H1+1
1630  GOTO 1500
1640  – – – NEXT STEP OF MAIN PROGRAM – – –
```

Example of the Shell Sort routine with line numbers for insertion into any program. Note that the only way to get to line 1640 is for J to be 0 in line 1470. In this case the "EXIT" is the next step of the main program.

"GOTO-less" techniques generally result in relocatable routines. A COBOL program can be made "GOTO-less" by using PERFORM commands in lieu of IF–GOTO commands. BASIC, requiring a line number for each line, and mandating a line number call in lieu of a name call for subroutines, isn't a likely candidate for writing relocatable routines. However, some statements lend themselves to relocatability: FOR–NEXT loops are automatically relocatable; and the versions of BASIC that allow BASIC statements in lieu of line numbers in IF–THEN and IF–THEN–ELSE sequences are also relocatable.

Even with full use of techniques such as those cited above, many BASIC routines aren't relocatable directly. So what do we do in those instances? A look at the attached figure provides one answer: write the program library version of the routine *without* line numbers, and assign *relative* addresses to IF–THEN, ON–GOTO, and GOTO statements. When you type the routine into your operating program, assign line numbers in decades (10 apart). (A text editor or basic interpreter with an "autoline" decade line numbering capability is a big help here!) Then, when you come to a command with a number in parentheses (the relative address), just add this number algebraically to the current line number to obtain the absolute address for the GOTO.

If you modify a relocatable routine taken from your program library – *use extreme caution!* You can easily destroy the relative address structure. Number any insertions *in between* decades assigned to the library version; RESEQencing to even decades should *not* be used. (This is no problem, of course, if you don't have DESEQ–RESEQ in your system.)

For instance, if you decide to print the value of "D" in the Shell Sort so that you can monitor the progress of the sorting, insert the PRINT "D="; D statement after the line (which ends in "0") for D=2*D using a line number of, say, 5 greater. You would normally do this in editing a program – but it is essential that you leave the line number alone in this case, rather than readjusting to even decades.

Also, the statement called EXIT at the end of the example routine is a dummy. If the routine is used as a subroutine, substitute RETURN for EXIT; otherwise use either a GOTO to an absolute address (statement number) or the next line of a continuing program.

Incidentally, the Shell Sort routine should be in everyone's library – it's the optimum combination of fast sorting power, short program and minimum memory. Woodrum's algorithm is reputedly faster, but takes much more program and more than twice the memory, since a link list must be generated even to sort a simple list. Relative address techniques make inserting the Shell Sort into any program very simple. □

Robert Irving is an aerospace engineer who has been involved in computer applications since the early 1960s. Initially involved in real-time computations on the Navy's Polaris program, he later helped develop an early IC computer (1965), established requirements for a semi-physical missile flight simulation facility using a hybrid combination of digital and analog computers, and holds a patent on a system for calibration of large tracking antennae. He holds Masters degrees in electronics and management science.

Only

Computer Enterprises Has All 3:

☒ 1. Lowest Prices
☒ 2. Reliability
☒ 3. Speediest Shipping

North Star Horizon Computer System
The Complete Z80A System
*Z80A CPU at 4 MHZ
* 16K 200 ns RAM
* Serial I/O * 1 or 2 micro disk drives
* DOS and BASIC

	Credit Card Price	Cash Discount Price
Horizon 1 (1 drive) kit	$1497	**$1439**
Horizon 1 (2 drives) kit	$1871	**$1799**
THE standard of Video Display Terminals— Lear Siegler ADM-3A Kit	Call or write for price	
SPECIAL TOTAL SYSTEM combination SAVE $50 MORE— Horizon 1 and ADM-3A kits	$2214	**$2129**
Horizon 2 and ADM-3A kits	$2589	**$2489**

SEND FOR YOUR FREE COPY OF COMPUTER ENTERPRISES DISCOUNT CATALOG

Polymorphic VTI/64 kit	$186	**$179**
IMSAI 8080 with 22 slots kit	$614	**$590**
IMSAI Factory Assembled 16K RAM	$464	**$446**
IMSAI Factory Assembled 32K RAM	$748	**$719**
IMSAI Video Interface VIO-B kit	$234	**$225**
IMSAI Video Interface VIO-C kit	$278	**$267**
Seals 250ns 8K RAM kit	$250	**$240**
TDL ZPU kit	$252	**$242**
4K Expansion for TDL Z16K	$ 99	**$ 95**
SEMI 4200 Chips	$ 13	**$ 12**
TDL 8K BASIC Paper Tape	$ 47	**$ 45**
TDL 12K BASIC Paper Tape	$ 89	**$ 86**
TDL Macro Assembler Paper Tape	$ 47	**$ 45**

Shipping charges: $10 per CPU on larger units; $1.50 per kit. $2.00 min. per order.
Delivery is stock to 30 days on most items. Shipment is immediate for payment by cashier's check, money order or charge card. Allow 3 weeks for personal checks to clear. N.Y. State residents add approp. sales tax. Availability, prices and specs may change without notice.

Write or Call

computer enterprises™

Fayetteville, N.Y. 13066
P.O. Box 71
Phone **(315) 637-6208** Today!

CIRCLE 13

Get Some Answers


Minicomputer News

Oceanography

Ships' officers use simulators to learn vessel operation

DEC adds three disk drives and cuts RK06 prices

DG printer line made in-house, offers international fonts

Inside This Issue

Oceanography 1

4 6 8 10 11 17

Sections

Departments

If you're a top or middle manager who knows little about minicomputers and the problems they can help solve, then you're just the person we can help.

Twice a month — in easy-to-read, easy-to-understand articles — you'll discover how your colleagues in business, industry and science use — or sometimes abandon — minicomputer solutions to problems.

You may be able to apply their solutions directly to your problems, use their solutions to spark your own ideas or you may develop solutions wholly your own.

No other publication gives you as much know-how about minicomputers and how they help solve business problems as MINICOMPUTER NEWS — and all for just $9.00/year. Just fill in the coupon below and we'll start helping you right away.

Minicomputer News

The newspaper that gives real coverage to the rapidly growing minicomputer market.

RATES	1 yr.	2 yrs.	3 yrs.
U.S.	$9	$15	$18
Canada & Mexico	$15	$25	$30
Other foreign —			
Surface	$40	$70	$80
Air	$60	$100	$120

Minicomputer News
1050 Commonwealth Ave., Boston, MA 02215

Name_____ Title_____

Company_____ Zip_____

Address_____

City_____ State_____ Zip_____

Outside U.S.A.: Country Name_____

I buy/specify (circle all that apply)
1. Minicomputers
2. Small business systems
3. Intelligent terminals
4. Microcomputers/processors
5. Add-on memories
6. Disk/tape drives
7. Printers/plotters
8. Interactive terminals (CRT/hardcopy)
9. Punched tape/card/OCR equipment
10. Modems/multiplexers
11. Software/support services
12. Word processors
13. Work stations/enclosures/secured systems
14. DP supplies

My business/industry (circle one):
1. Finance/insurance/real estate
2. Wholesale/retail trade
3. Industrial/consumer products mfr.
4. Utilities/communications/transport
5. EDP services
6. Health care/education/law
7. Printing/publishing/word processing
8. Petroleum/chemical/mining/construction
9. Government/military
10. Minicomputer/peripheral manufacturer
11. Turnkey systems/software
12. Consulting (EDP)
13. Research

My job function/title (circle one):
1. General/corporate management
2. Financial management
3. DP management
4. Engineering management
5. Marketing management
6. Systems/applications eng.
7. Consultant
8. Purchasing/procurement
9. Sales/distribution

A. Education/Library
Z. Other

NOTE: The information in the buy/use, business/industry and function/title columns is needed for statistical purposes so that we know who our readers are and what products interest them.

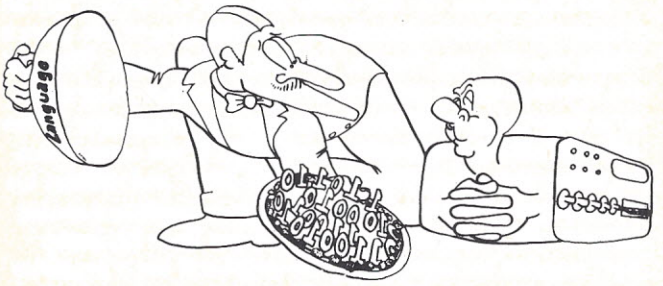
To order your subscription, clip this coupon and mail it with your check or money order.

INSIDE A MICROCOMPUTER

About programming languages

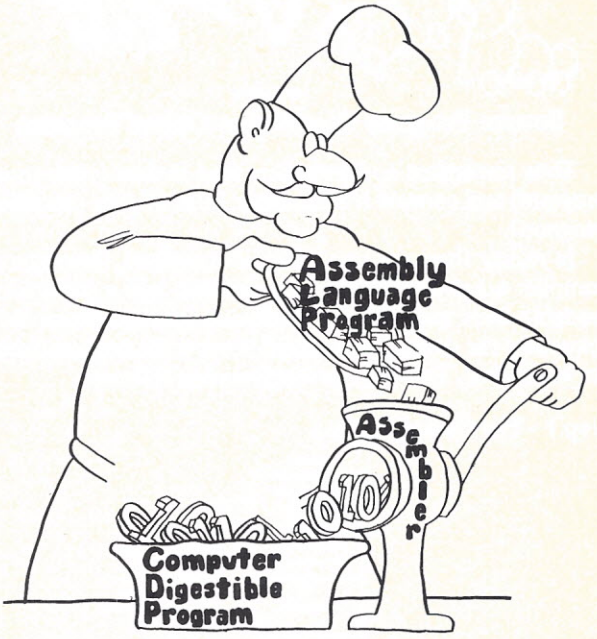
There are so-called "higher level" languages, such as BASIC, FORTRAN and COBOL. There are also "fundamental" programming languages referred to as "assembly language".

Regarding any programming language, the most important point to understand is that a programming language is a programmer's convenience. A programming language is an artificial creation, designed to make your life as a programmer easier. Whatever language you decide is best for you, the computer still demands that it receive the program as a sequence of numbers.



Now the computer will, itself, take care of converting the program from the form in which you, the programmer, write it, to the form in which it, the computer, can understand and execute it. In order to make this conversion, the computer executes another program – a program which someone else wrote for you.

A program called an "assembler" converts programs which you write in assembly language into programs which the computer can understand and execute.



A program referred to as a "compiler" accomplishes the same conversion task for programs which you write using a higher level language.

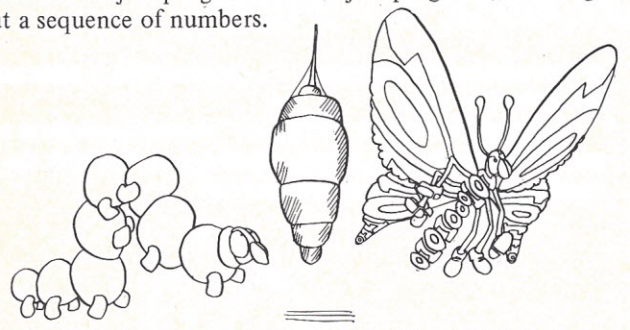
Assemblers and compilers treat your program as data; they read in data (your program) and convert it to another

Reprinted with Permission. "An Introduction to Microcomputers. Volume 0. The Beginner's Book." Adam Osborne and Associates, Inc. Berkley, CA. Copyright © 1977.

Technologist Arthur C. Clarke once said, "Any sufficiently advanced technology is indistinguishable from magic." If computers seem like magic to you, this article may shed some light on their inner workings.

form of data (the computer-executable version of your program).

We refer to a program in human readable form as a "source program". That is to say, a source program is a program written in a programming language. Once the program has been converted into its computer readable form, it is called an "object program". An object program is nothing but a sequence of numbers.

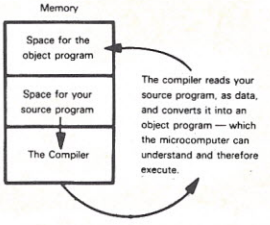


Source Program Conversion Object Program

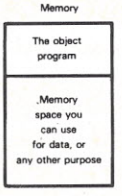
Thus assemblers and compilers read in data (your source program) and convert it to another form of data (an object program).

In reality there are two types of compilers. One type of compiler takes your program, converts it into a computer readable form and saves the computer readable form. Subsequently the computer readable form is loaded into memory for execution. This may be illustrated as follows:

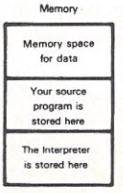
Step 1 - The Compiling Step



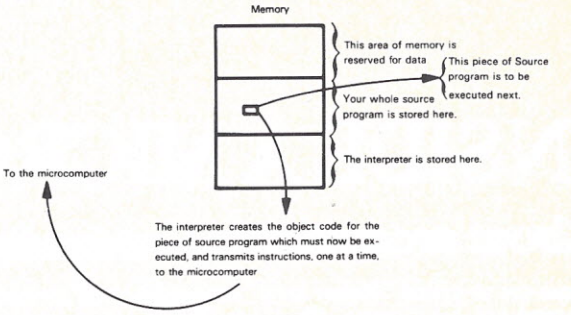
Step 2 - The Execution Step



Another type of compiler never saves the computer readable form of your program (i.e., the object program). This type of compiler is called an "interpreter". When you use an interpreter, your whole source program resides in memory along with the interpreter, for as long as the source program is being executed. This may be illustrated as follows:



The interpreter converts your source program into object code as needed. This may be illustrated as follows:



The illustration above shows an area of memory being set aside for your whole source program. You might be misled into thinking that the amount of memory set aside for your source program puts an upper bound on the size of source program which you can execute. In fact, you can execute much larger programs so long as the larger program can be broken into blocks, where no one block overflows the available source program memory space.

Compilers and interpreters are themselves object programs which someone else wrote for you.

We can explain the difference between a compiler and an interpreter in non-technical terms by thinking of the ways in which an actor may learn to deliver lines in a play. Think of the source program as the actor's script; object program instructions going to the microcomputer are equivalent to the actor delivering his lines to an audience. If the actor learns his entire part, then throws away the script and delivers his lines, what he has done is equivalent to compiling a source program. But suppose the actor does not learn his entire part; suppose the actor keeps the script and has a prompter display his lines one at a time using prompting boards. He is now delivering his lines in the fashion of an interpreter.

BASIC is the most popular microcomputer higher level language; it is also an interpreter language.

In summary, we can divide most programming languages into "higher level" languages and "assembly" languages. Higher level languages are converted into object programs by compilers and interpreters. Assembly languages are converted into direct code by an assembler.

The principal difference between higher level languages and assembly language is the fact that higher level languages are designed to represent problems, whereas assembly languages are designed to represent the computer. Thus a computer views a higher level language source program as a very alien thing and a compiler has a big job converting the source program into an object program. In contrast, an assembly language source program can be converted into an object program quite easily; an assembler is therefore a relatively simple program. Let us now compare higher level languages and assembly language in order to more clearly identify differences between the two.

A comparison of higher level languages and assembly language

We will first look at the advantages of higher level languages.

Higher level languages are easier than assembly language to use; that is because higher level languages represent the problem rather than the computer. For example, a simple addition would be written in this self-evident form using a higher level language:

SUM = VAL1 + VAL2

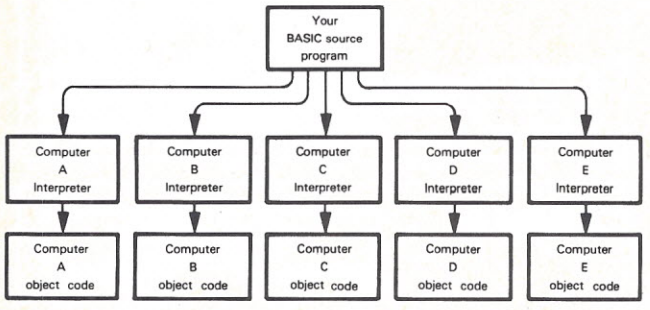
VAL1 and VAL2 are names you assign to an augend and an addend – which can have any values. SUM is the name you assign to the sum. Assembly language presents you with a definition of your computer – in a human readable form. Thus the addition illustrated above would be programmed in assembly language as follows:

```
LXI    H, VAL1
LDA    VAL2
ADD    A,M
STA    SUM
```

VAL1 and VAL2 are no longer names you assign to the augend and addend. VAL1 and VAL2 are now addresses – they identify memory locations in which the augend and addend are stored. Thus the augend and addend must each be small enough to fit within one memory location. SUM, likewise, is the address of the memory location where the sum will be stored – providing it will fit into one memory word.

The assembly language definition of the addition is by no means self-evident.

There is another important advantage associated with the fact that higher level languages are "problem oriented". What we mean by "problem oriented" is that the language is not designed with any computer in mind. Therefore if you write a program in a higher level language, you can convert this higher level language source program into an object program that will run on any computer – providing the computer has a compiler (or interpreter) for your higher level language. Suppose, for example, you write a program in BASIC. You can execute the BASIC program on your computer, and all of your friends can execute your program on their totally different computers – providing their computers also have BASIC interpreters. This may be illustrated as follows:



Assembly language, on the other hand, is a human representation of the computer you are using. Thus, every single computer and microprocessor has its own, unique assembly language; and a program written in one computer or microcomputer's assembly language is totally unintelligible to any other computer or microprocessor. If you write an assembly language source program for your microprocessor, only people with microcomputers containing your microprocessor will be able to assemble and run your source program.

In theory it would be possible to write a program akin to a compiler that would take a source program written in one microprocessor's assembly language and convert it into an object program for another microprocessor. In reality few people do this, since another microprocessor's assembly language is as strange and hard to deal with as a higher level language.

With all the advantages that accrue from programming in a higher level language, why would anyone bother with assembly language? Assembly language also has advantages.

In the first place, assembly language generates much shorter object programs than higher level languages. This is because the assembly language for each microprocessor or computer is designed specifically for that microprocessor or computer. In fact, an object program created by a compiler from a higher level language source program is usually 2 to 4 times as long as the same object program created by an assembler from an assembly language source program. This is because the compiler must, in reality, write an assembly language program to represent the problem as defined in the higher level language. But whereas a human programmer can write an assembly language program using human judgement, a compiler must do the job by fixed rules.

Consider an everyday analogy: you must give someone directions to drive from one point to another in a city. If you know the exact source and destination, and the exact city, you can define a very direct route.

Now try to create a set of general-purpose instructions which you can string together in order to define the route to be driven between any two points in any city. These instructions, if they are to be interpreted by a machine, can leave nothing to the imagination. Thus there must be some fixed number of instructions such as:

Turn left
Turn right
Test for a one way street
Test for a dead end road
Test for a 45° turn
etc.

You cannot include instructions that assume you know whether or not a street is one way, since one way streets are subject to change. You cannot include instructions that simply define the number of blocks to travel in a straight line, since there may be barriers in the road preventing such travel, or in cities with steep hills such as San Francisco, a road which appears to be continuous in reality has a 100 foot (i.e., 30 meter) precipice dividing it at some point.

Once you start devising a set of general purpose direction rules that take into account undefinable contingencies, you will have some idea of the problem faced by a compiler. The compiler does not know what the peculiarities of any specific computer may be; therefore it must generate programs that take into account the strangest possiblities.

Higher level languages have another problem. The compiler which converts a higher level language source program into an object program is itself a large program. A compiler program may be eight times as long as an assembler program. Thus until your microcomputer system is quite large you cannot use a higher level language, since your microcomputer system will have insufficient memory to hold the compiler.

If you have an interpreter, then the interpreter must always be in memory, together with the program you are executing. This difference between a compiler and an interpreter was illustrated earlier in the article.

The fact that higher level language source programs generate longer object programs also means that the object program will take longer to execute, since there are more instructions to be executed. If your application is running into speed problems, you can speed things up by a factor of 2, or more, by simply rewriting your program into assembly language.

Even some of the advantages associated with higher level languages are not all they appear to be. For example, higher level languages are supposed to be portable; that is to say, one higher level language source program can be compiled and executed by many different microprocessors. This is not always true. Frequently you will find that there are minor differences in the way one computer's compiler expects the source program to appear, as compared to the next. However, even in the worst case, the changes you would have to make to a higher level language source program, when going to a new microprocessor or computer, are tiny compared to the problems associated with completely re-writing the program in the new microprocessor or computer's assembly language.

What then is our conclusion?

If you are going to use a microcomputer simply as a vehicle for executing programs, you should go to higher level languages as quickly as you can. If, on the other hand, you plan to get inside the microcomputer itself, building your own, changing it, extending it, or otherwise playing with its components, then you should learn assembly language as quickly as possible, and you will probably stay with assembly language.

Microcomputer functional logic

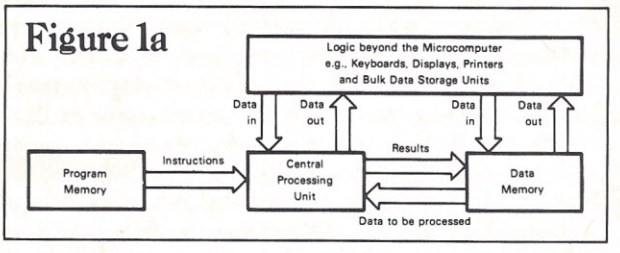
The object program you create determines the functions that will be performed by the logic of your microcomputer.

Functionally Figure 1A illustrates the logic of a microcomputer; this is the logic which we are now going to discuss.

It does not matter what the microcomputer is going to do – ultimately the task consists of these three steps:

1) Bringing data into the microcomputer.
2) Modifying the data.
3) Transmitting the modified data back out from the microcomputer.

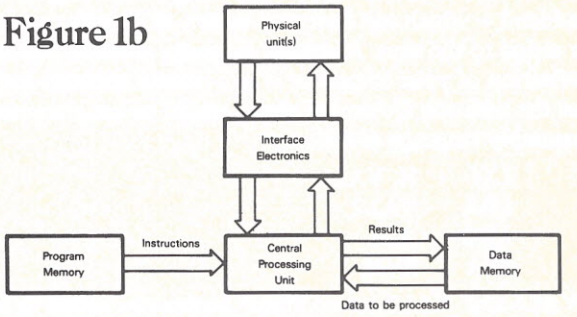
Figure 1a



Logic beyond the microcomputer (which consists of physical units) is used to enter information, receive results and store large quantities of data. Data that is in the process of being operated on is stored in data memory, which is fast access, read/write memory. Therefore, steps 1) and 3) above are handled by the shaded microcomputer logic shown in Figure 2.

Physical units transmit information to and from the microcomputer via appropriate interface logic. With reference to Figure 1B, this may be illustrated as follows:

Figure 1b



Operations which are actually performed on data are performed by logic within the Central Processing Unit. These operations are defined by a sequence of instructions which, taken together, constitute a program. The program is stored in program memory. Thus step 2) of the above three steps is handled by the shaded microcomputer logic shown in Figure 3.

Program memory can be read only memory, or it can be read/write memory. Program memory can be read only memory because instructions are transmitted from the program stored in program memory to the Central Processing Unit; but instructions are usually not transmitted from the Central Processing Unit to program memory. Program memory does not have to be read only memory. It is common practice in microcomputer systems to separate programs from data, as shown in Figure 1A, and in many industrial microcomputer applications, programs are held in read only memory to ensure that the program is never accidentally changed or lost.

Figure 2

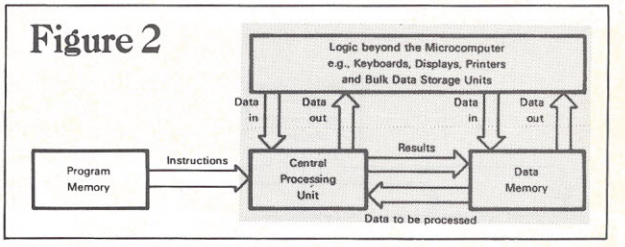
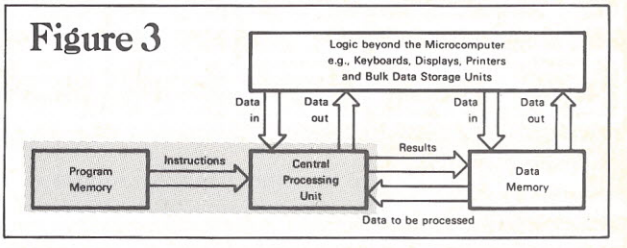


Figure 3



But program memory and data memory could be one and the same memory; moreover, it is possible for one part of a program to treat another part of the program as data, in which case the program changes itself. As you might expect, programs which change themselves can become very complex; so at least while you are a beginner, it is wise to think of pro-

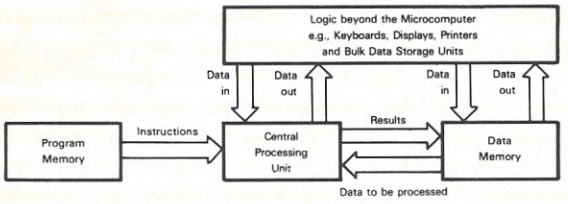
gram memory and data memory as separate and distinct entities.

The fact that you do not have a good understanding yet of how program and data memories work is unimportant. Program and data memory chips can store information in a computer-readable form. For now that is all you need to know about program and data memory.

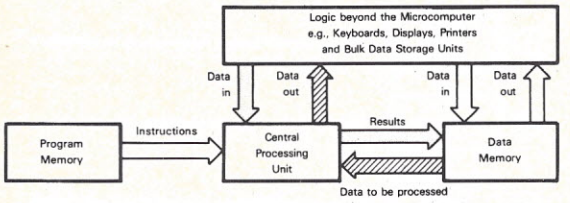
Information Paths

Let us now consider the various information paths shown in Figure 1.

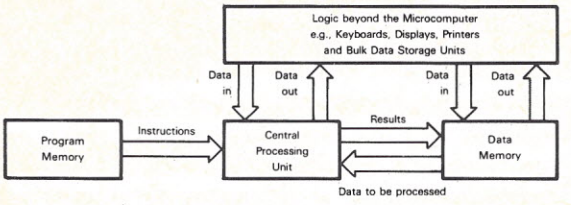
When the Central Processing Unit is modifying data, it usually fetches the data to be modified from data memory, and it usually returns the results to data memory. Therefore there are paths in both directions between data memory and the Central Processing Unit:



New data entering the microcomputer travels from external physical units to data memory via the Central Processing Unit. Results being output travel from memory via the Central Processing Unit to external physical units. This may be illustrated as follows:

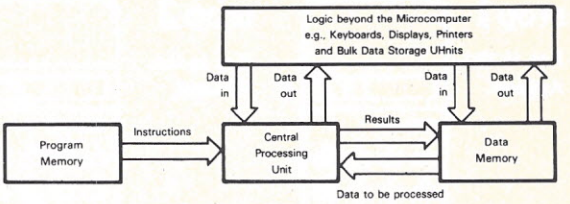


High speed information transfer between floppy disk and data memory frequently occurs directly between these two devices, bypassing the CPU:



The data path illustrated above is referred to as Direct Memory Access. Direct Memory Access is usually referred to by its initials: DMA. While memory has to be at one end of the DMA data transfer, a floppy disk need not be at the other end, even though it frequently is. Any external logic may provide the other end of the DMA data transfer.

Whenever the Central Processing Unit is doing something – moving data or modifying data – a stream of instructions transmitted from program memory to the Central Processing Unit controls Central Processing Unit operations. Thus there must be a unidirectional path for information to flow from program memory to the Central Processing Unit:

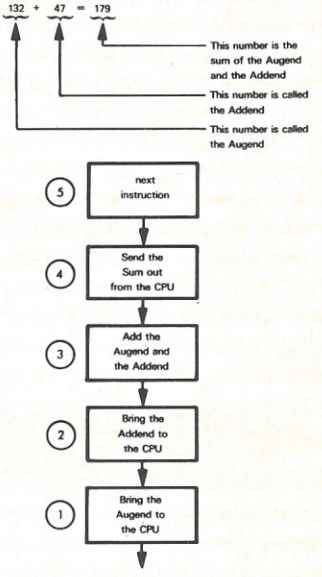


The central processing unit

Central to all microcomputer logic is the Central Processing Unit. The Central Processing Unit is the electronic logic which actually performs all operations on data; that is to say, in various other parts of the microcomputer system you can move data from one location to another, but only within the Central Processing Unit can you actually change data. The Central Processing Unit is usually referred to by its initials: "CPU".

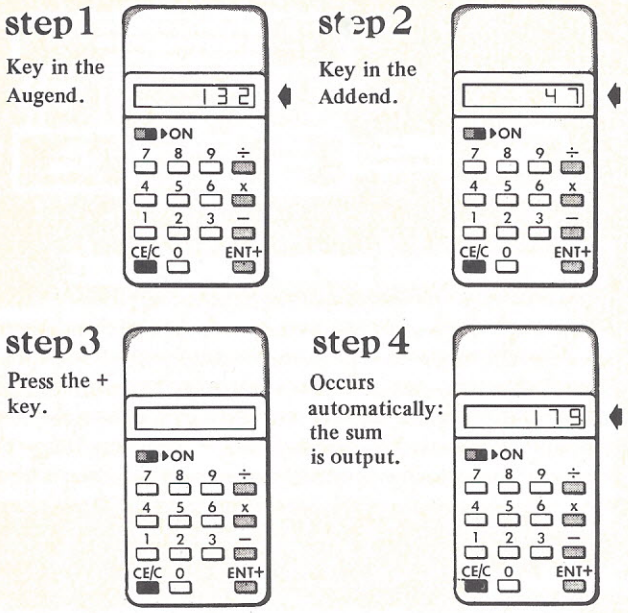
Serial Logic

In order to generate the versatility and power commonly associated with computers, Central Processing Unit logic must be capable of performing a large number of different operations; and that is indeed what the Central Processing Unit can do. However, the Central Processing Unit can only perform one operation at a time. Consider the addition of two numbers; when two numbers are added, they are called the Augend and the Addend. The Augend and the Addend are summed via the following serial sequence of events:



Each event is identified by a number 1, 2, 3, 4, etc. The CPU performs each event as a single operation. Therefore, in order to perform the addition illustrated above, the CPU performs event 1, then event 2, then event 3, then event 4.

During the first step the Augend is brought to the CPU. During the second step the Addend is brought to the CPU. During the third step the Augend and Addend are summed by electronic logic within the CPU. During the fourth step the sum is transmitted out from the CPU. These four steps are essentially identical to the four steps via which you will add two numbers using many older hand-held calculators.



Now you know why calculators used to make you do things awkwardly; they were forcing you to use computer logic sequences. This cut the cost and complexity of the calculator.

More recent calculators use more complex logic which lets you work in human sequence:
During step 1 you key in the Augend.
During step 2 you press the + key.
During step 3 you key in the Addend.
Step 4 occurs automatically: the sum is output.

We can use the four hand-held calculator steps (either version) via which you add two numbers to illustrate the concept of a serial device, since a hand-held calculator and a Central Processing Unit are both serial devices; each can perform just one operation at a time. This is simple enough to understand in the case of a hand-held calculator; you cannot, for example, simultaneously key in the two numbers which are to be added. The two numbers must be keyed in serially, one after the other. In the case of a Central Processing Unit, you cannot simultaneously bring the Augend and the Addend to the Central Processing Unit; each number must be fetched via an independent step, and the two steps must occur one after the other.

Serial Logic Step

The next problem that we are going to run into is determining what a single "step" consists of. In the case of the hand-held calculator, this is not a very important consideration. When you enter the number 132 via the keys, does entry of the entire number constitute one "step"? Or does each keystroke constitute and individual "step"? Frankly, for a hand-held calculator, this question is inconsequential. But what if you have to write down a sequence of instructions which someone else must follow? You could write down the following single step:
1) Enter 132 at the keyboard.

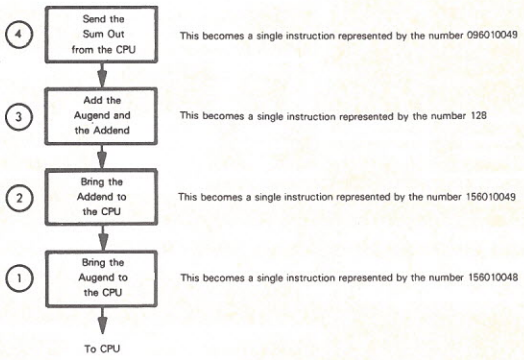
You could break up the one step into three separate steps:
1) Press the 1 key.
2) Press the 3 key.
3) Press the 2 key.

Consider an even more mundane example; eating a piece of cake.

Suppose a piece of cake can be eaten in ten mouthfuls; is eating this piece of cake a ten-step process? Perhaps, but perhaps not. Eating a single mouthful of cake may itself consist of these four steps:
1) Separate a piece of cake with your fork.
2) Impale the separated piece of cake on the end of your fork.
3) Transfer the separated piece of cake to your mouth.
4) Chew and swallow the piece of cake.

It would be easy to nitpick these four cake eating steps, creating any number of additional smaller steps. The same is true of single Central Processing Unit steps. Some Central Processing Units perform operations in relatively big steps; others sequence events as a series of relatively small steps. But for every Central Processing Unit, every step is clearly and unambiguously defined as an "instruction". There is nothing vague about an individual instruction, or step, that can be executed by any Central Processing Unit.

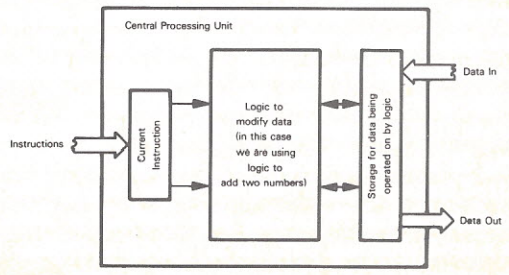
Every Central Processing Unit responds to a fixed number of instructions. These instructions, taken together, are referred to as an instruction set. Typically a Central Processing Unit will have from 40 to 200 different instructions in its instruction set. Every instruction is represented by a unique number, which when transmitted to the Central Processing Unit at the proper time, causes the Central Processing Unit to execute the operations associated with the instruction. For example, our addition sequence may be illustrated as follows:



Central Processing Unit Local Data Storage

The four instructions shown above illustrate a logistic problem associated with the CPU.

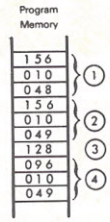
The CPU has storage space to hold the data that it is about to operate on, and that is all. This may be illustrated as follows:



You cannot expect to leave the Augend, Addend and sum in the Central Processing Unit data storage space, because you will almost certainly need this space for the very next operation which the Central Processing Unit performs. The Augend, the Addend and the sum must therefore have permanent storage locations somewhere beyond the Central Processing Unit – for example, in external read/write memory. That is why steps 1, 2, 4 are present.

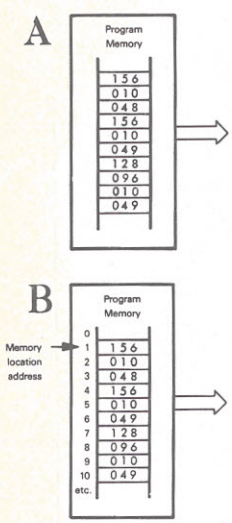
Program Memory

In order to perform any operation, such as the illustrated addition, you must create a sequence of instructions, which taken together constitute a program. The program is a sequence of numbers. This sequence of numbers is stored in a fast access memory, which we call program memory. Using arbitrarily assigned number codes for the addition instructions, the addition program may be represented conceptually, as shown above.



Memory is being likened to a ladder of "pigeon holes"; each pigeon hole represents an individually identifiable and addressable location.

Whenever a number is transferred from the CPU to memory, one "pigeon hole" will be filled. When a number is transferred from memory to the CPU, the CPU receives the contents of one "pigeon hole".



Memory Locations and Addresses

Each "pigeon hole" is called a "memory location". Every memory location is individually identifiable via a unique memory address.

We are not going to concern ourselves with how you create the memory address which identifies any individual addressable location within memory; therefore the addition program sequence illustrated above will be represented occupying an undefined sequence of program memory locations as in A.

Without discussing memory addressing at all, we could illustrate the addition program instruction sequence occurring in the first ten addressable locations of program memory as in B.

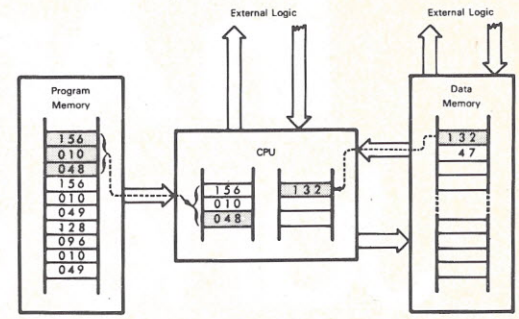
Data Memory

The information which is used by a program while it executes is referred to as data. In our simple addition example we are going to handle three pieces of data: the Augend and the Addend which are to be added, and the sum. These three pieces of data will likely be stored in local, fast access data memory.

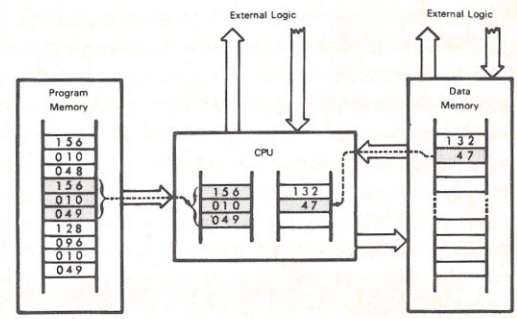
Addition Program Event Sequence

The process of adding two numbers may now be illustrated conceptually as follows:

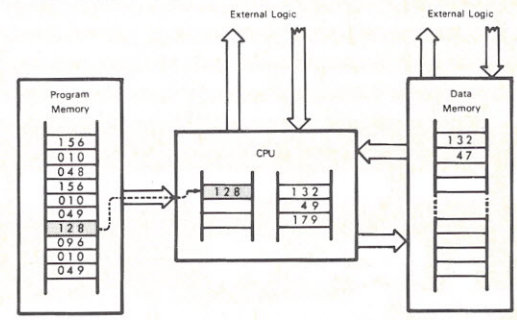
Step 1: Fetch the Augend.



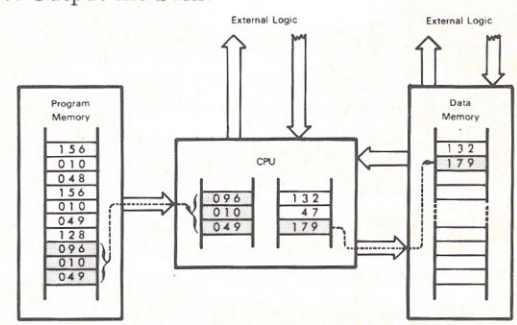
Step 2: Fetch the Addend.



Step 3: Generate the Sum.



Step 4: Output the Sum.



For each of the four steps illustrated above, the first event to occur will be the transfer of an instruction code from program memory to the CPU. In each step the instruction code is the shaded number in program memory. The CPU cannot know what to do until the instruction code has reached it. Once the instruction code has reached the CPU, operations required by the step actually occur. Operations are self-evident.

Note that in Step 4 the sum is arbitrarily shown being written back to the same data memory location from which the Addend was fetched. Thus the Addend will be lost.

Let's Get Personal in Anaheim

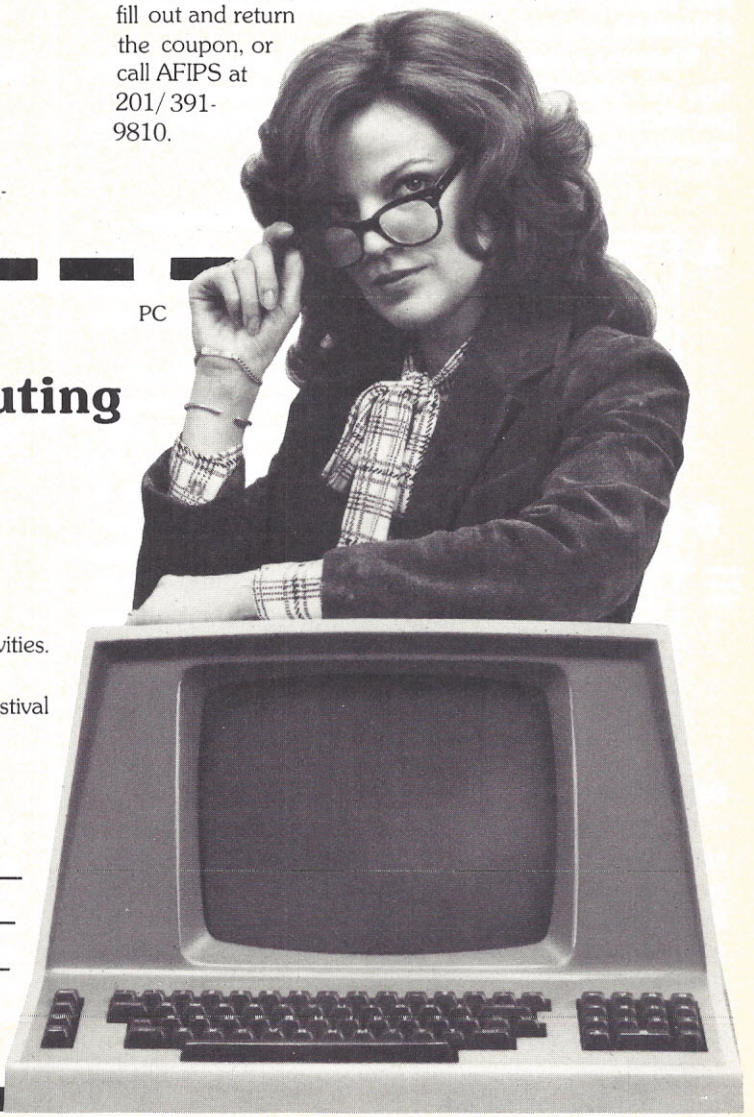
June 6-8, 1978

A rewarding personal experience is in store for you June 6 - 8 at the NCC '78 Personal Computing Festival...the most comprehensive personal computing event ever held. The Festival, a separate feature of the National Computer Conference, will include approximately 30 program sessions, commercial exhibits of consumer computing products and services, plus a contest featuring individually-designed microprocessor systems and applications. All Festival activities will take place in the Disneyland Hotel Complex, just a few minutes from the Anaheim Convention Center, site of this year's NCC.

Plan now to attend or participate in the big, new NCC '78 Personal Computing Festival. The program will include special paper, panel, and tutorial sessions on such topics as speech synthesis and recognition, computerized music systems, hardware and software design, computer graphics, and small business systems. To assist you in participating, program deadlines have been extended to March 1 for letters of intent covering proposed papers or sessions, and April 1 for submittal of final papers.

The Festival contest provides a unique opportunity to demonstrate your own accomplishments in hardware, software, and applications ranging from home-brew DOS to educational applications and games. Deadline for submittal of information on proposed demonstrations is March 1.

Don't miss the year's most exciting personal computing event. For additional information fill out and return the coupon, or call AFIPS at 201/391-9810.



PC

NCC '78 Personal Computing Festival

c/o AFIPS, 210 Summit Avenue
Montvale, N.J. 07645
telephone: 201/391-9810

☐ Please keep me up-to-date on Festival plans and activities.

☐ Please rush me information on participating in the Festival program sessions and contest.

☐ My company is interested in exhibiting at the Festival.

Name _____

Title _____

Company _____ Division _____

Street _____

City _____ State _____ Zip _____

Flashes From The Chess Wars

Toronto tournament

. . . . Standings after the first round at the tournament included six teams that had won their initial games, four teams that had draws and six teams, of course, that had lost their initial games. The six teams that successfully survived the first round were three teams from the USA, one team from Canada, one from the U.K. and the entry from Sweden. The United States had six different teams in the tournament, Canada had three, United Kingdom had two and the others (Russia, Sweden, Germany, Netherlands and Switzerland) each had one team entered. The teams were affiliated with the following organizations: Moscow's Institute for System Studies *(Kaissa);* Northwestern University *(Chess 4.6);* University of Southern Mississippi *(Blitz V);* Rutherford Lab and AERE of Harwell, U.K. *(Master);* Switzerland's Eidgenossische Technische *(Tell);* Duke University *(Duchess);* Bell Telephone Labs, N.J. *(Belle);* Canada's University of Edmonton *(Wita);* Canada's McGill University *(Ostrich);* Sweden's Telefon AB LM Ericsson *(Dark Horse);* London's Queen Mary College *(BCP);* a private entry from the Netherlands *(BS'66'-76);* West Germany's Technischen Universitat *(Elsa);* University of Michigan *(Chaos);* Sperry Univac, St. Paul MN *(Black Knight);* and Canada's University of Toronto *(Chute 1.2).* Following are the eight games played in the second round:



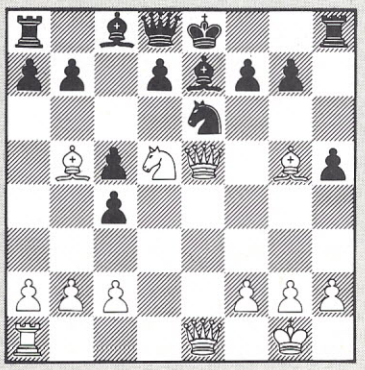
Record crowds at the Toronto tournament attended an exhibition game between the new word computer chess champions. Chess 4.6 of Northwestern University, and the previous champions, Kaissa of the Institute for System Studies of the U.S.S.R. In the four-game, Swiss-style tournament, they had not met because of Kaissa losing its first game to Duchess, the entry for Duke University. The Kaissa team (backs to the camera) were using a Toronto-based IBM-370/168 and Chess 4.6 was connected to a Control Data CYBER 176 at Control Data's systems laboratory in Arden Hills, Minnesota. Photo, courtesy of INFO, Publication of Control Data Canada, Ltd., Willowdale, Ontario.

1.	P-Q4	P-Q4
2.	P-K4	PxP
3.	N-QB3	N-KB3
4.	P-KB3	PxP
5.	QxP	QxP
6.	B-K3	Q-QN5
7.	0-0-0	B-N5
8.	N-N5	N-R3
9.	Q-P	BxR
10.	N-Q6ch	QxN
11.	KB-N5ch	P-B3
12.	BxPch	N-Q2
13.	QxRch	N-N1
14.	B-QN5	QP-R3
15.	BxNch	KxB
16.	Q-N7ch	K-K3
17.	Q-K4ch	K-Q2
18.	B-B4	P-K4
19.	BxP	Q-R3ch
20.	KxB	B-Q3

Black: *Chute 1.2*	White: *BS '66 '76*
21. N-B3	R-B1
22. Q-N7ch	B-B2
23. Q-Q5ch	K-K1
24. BxB	RxB
25. R-K1ch	R-K2
26. RxRch	KxR
27. Q-K5ch	Q-K3
28. QxN	Q-Q4ch
29. K-B1	QxP
30. Q-N7ch	K-B3
31. Q-B6ch	Q-K3
32. Q-B3ch	K-N3
33. N-R4ch	K-R5
34. Q-B3ch	KxN
35. Q-B4ch	K-R4
36. P-KN4ch	QxP
37. QxPch	K-R3
38. Q-B1	Q-N4ch
39. K-N1	Q-QR4
40. Q-R3ch	Q-KR4
41. Q-K6ch	Q-N6
42. Q-K3ch	Q-N4
43. Q-K6ch	Q-B3
44. Q-R3ch	K-N3
45. Q-N4ch	K-B2
46. Q-B4ch	K-N3
47. Q-K4ch	K-R3
48. P-QN4	Q-B8ch
49. K-R2	Q-B2ch
50. K-R3	Q-B3
51. Q-K3ch	K-N3
52. Q-Q3ch	K-R3
53. Q-R3	K-N3
54. K-N3	Q-B2ch
55. K-R3	Q-B5
56. Q-N3ch	K-B2
57. Q-B3ch	K-N3
58. Q-N3ch	K-B2
Draw agreed	

White: *Master*	Black: *Chess 4.6*
1. N-KB3	P-Q4
2. P-QB4	PxP
3. N-QR3	P-K3
4. Q-R4	B-Q2
5. QxP/B4	N-QB3
6. P-K3	N-B3
7. B-Q3	P-QR3
8. N-B2	P-QN4
9. Q-B4	B-Q3
10. Q-N5	0-0-0
11. 0-0-0	P-K4
12. Q-R4	Q-K2
13. B-K4	NxB
14. QxN	K-R1
15. P-KN4	N-R4
16. P-KN5	B-B3
17. Q-KN4	BxN
18. QxB	QxP
19. Q-N2	QxQ
20. KxQ	P-K5
21. P-B3	PxP
22. RxP	P-KB4
23. P-N3	N-B3
24. B-N2	N-K4
25. BxN	BxB
26. R/1-KB1	P-N3
27. P-KR3	P-B4
28. P-Q4	PxP
29. PxP	B-Q3
30. N-K3	R/B-K1
31. R/1-B2	R/R1-Q1
32. R-Q2	B-N5
33. R-Q3	B-B1
34. P-Q5	R-K4
35. P-QR4	PxP
36. PxP	B-QB4
37. P-Q6	BxP
38. N-B4	R-K3
39. NxB	R/3xN
40. RxR	RxR
41. R-QB3	R-Q5
	White resigns

White: *Kaissa*	Black: *Tell*
1. P-K4	P-K4
2. N-KB3	N-QB3
3. B-N5	N-B3
4. 0-0-0	NxP
5. P-Q4	
6. NxN	PxN
7. QxP	N-B4
8. R-Klch	N-K3
9. N-B3	P-QB4
10. Q-K5	P-KR5
11. N-Q5	B-K2
12. B-N5 (See Figure)	Q-R4
13. BxB	P-R3
14. QxKNP	R-R3
15. Q-N8ch	N-B1
16. QxN mate.	

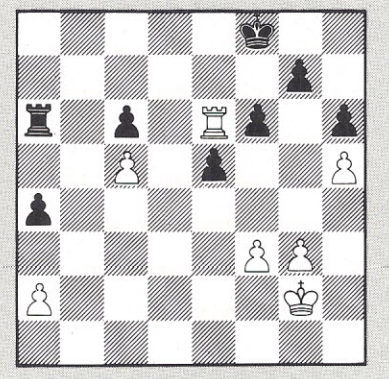


Kaissa now had 4 major pieces poised on *Tell*'s territory in addition to the Rook in King's file. At this point *Tell* could only survive for 4 more moves.

White: *Blitz*	Black: *Belle*
1. P-K4	P-K4
2. N-KB3	N-QB3
3. B-N5	N-B3
4. 0-0	NxP
5. R-K1	N-Q3
6. NxP	B-K2
7. BxN	QPxB
8. N-QB3	0-0
9. Q-R5	R-K1
10. P-Q4	B-K3
11. B-B4	N-N4
12. N-N	PxN
13. N-B3	Q-Q2
14. R-K3	P-R4
15. P-KR3	P-R5
16. B-K5	Q-B3
17. P-B3	P-R3
18. P-R3	R/R1-Q1
19. N-Q2	B-N4
20. R-K2	P-KN3
21. Q-B3	QxQ
22. NxQ	B-QB5
23. R/2-K1	P-QB3
24. NxB	PxN
25. B-B6	R-QB1
26. BxP	R-R1
27. R-K7	RxR
28. BxR	R-K1
29. R-K1	B-N6
30. R-K5	B-R7
31. P-KB4	B-K3
32. B-B6	R-KB1
33. P-R4	P-R4
34. R-K7	B-B1
35. P-KN3	K-R2
36. K-N2	K-N1
37. K-B3	P-N3
38. K-K4	B-B4ch
39. K-K3	R-B1
40. K-B3	R-N1
41. R-K5	B-B7
42. P-Q5	PxP
43. RxP	P-N5
44. RPxP	R-K1
45. R-Q6	B-K5ch
46. K-K3	P-QN4
47. R-Q4	B-B3ch
48. B-K5	B-N7
49. K-B2	B-B3
50. K-K2	B-N7
51. K-K3	P-B3
52. R-Q6	PxB
53. RxPch	K-B2
54. P-B5	B-R6
55. P-N4	R-KN1
56. RxR	KxR
57. K-B3	P-K5ch
58. K-B4	P-K6
59. KxP	BxP
60. K-K4	K-N2
61. K-B4	B-K7
62. K-N5	B-Q8
63. P-B6ch	K-R2
64. P-B4	PxP
65. P-N5	P-B6
66. PxP	P-R6
67. P-B7	K-N2
68. P-B8 (Q)ch	KxQ
White resigns	

1.	N-QB3	P-K4
2.	N-B3	N-QB3
3.	P-K4	B-N5
4.	N-Q5	N-B3
5.	NxB	NxN
6.	P-B3	N-B3
7.	Q-K2	0-0
8.	P-Q4	P-Q3
9.	P-QN3	B-N5
10.	P-Q5	N-K2
11.	P-N3	P-B3
12.	PxP	PxP
13.	B-N5	Q-R4
14.	Q-K3	N/KB3-Q4
15.	PxN	NxP
16.	Q-Q2	BxN
17.	P-QN4	Q-R6
18.	R-KN1	QxP/QB6
19.	QxQ	NxQ
20.	B-K7	R/KB1-K1
21.	BxP	N-K5
22.	B-B5	NxB
23.	PxN	R/QR1-Q1
24.	B-K2	BxB
25.	KxB	R-Q4
26.	R/QR1-QB1	R/K1-Q1
27.	R/KN1-Q1	R-R
28.	RxR	R-K1
29.	R-Q6	R-QB1
30.	K-B3	B-QR4

White: *Dark Horse* Black: *Chaos*



White now begins a series of useless checks with his single rook that carried the game into a total of 70 moves.

31.	K-K4	P-B3
32.	K-B3	P-R5
33.	R-Q7	R-R1
34.	R-Q6	R-R3
35.	K-N2	P-R3
36.	P-R4	K-B2
37.	P-R5	K-N1
38.	P-B3 (See figure)	K-B1
39.	R-Q8ch	K-K2
40.	R-Q6	K-B1
41.	R-Q8ch	K-K2
42.	R-Q6	K-K1
43.	P-R3	K-K2
44.	K-B2	K-B1
45.	R-Q8ch	K-K2
46.	R-Q6	R-Q6
47.	R-Q8ch	K-B2
48.	R-Q7ch	K-N1
49.	R-Q8ch	K-R2
50.	R-QB8	P-N4
51.	PxPch	KxP
52.	R-Kn8ch	K-B2
53.	R-QB8	K-K3
54.	R-K8ch	K-B2
55.	R-QB8	K-N3
56.	R-KN8ch	K-R4
57.	P-N4ch	K-R5
58.	R-N6	P-R4
59.	PxP	KxP
60.	RxP	K-N4
61.	R-K6	K-B4
62.	R-R6	K-N4
63.	R-Q6	K-B5
64.	R-N6	K-B4
65.	R-N4	R-R4
66.	R-QB4	K-K3
67.	K-K2	K-Q4
68.	R-K4	RxP
69.	RxP/QR4	R-B6
70.	R-R7	P-B4

Adjudicated a draw

1.	P-K4	P-K4
2.	N-KB3	NKB3
3.	P-Q4	B-K2
4.	PxP	NxP
5.	B-Q3	P-Q4
6.	PxKP	NxP
7.	0-0-0	0-0-0
8.	R-K1	B-N5
9.	P-B3	K-R1
10.	B-KB4	N-QB3
11.	QN-Q2	P-KN4
12.	B-K3	N-KB4

White: *Duchess* Black: *Ostrich*

13.	Q-K2	BxN
14.	NxB	NxB
15.	QxN	P-N5
16.	B-B5	R-KN1
17.	N-K5	NxN
18.	QxN	B-KB3
19.	Q-B4	B-KN4
20.	Q-K4	B-Q7
21.	QR-Q1	Q-N4
22.	R-K2	B-B5
23.	R-Q7	QR-K1
24.	QxR	RxQ
25.	RxR	K-N2
26.	B-K6	P-QR4
27.	RxKBPch	K-R3
28.	R-K7	Q-KN3
29.	B-B5	Q-KN1
30.	B-K4	Q-Q1
31.	R-K6	K-N4
32.	R-B5ch	K-R5
33.	R-R6 mate	

White wins

1.	P-K4	P-K4
2.	N-KB3	N-QB3
3.	B-N5	P-Q3
4.	P-Q4	PxP
5.	QxP	B-Q2
6.	BxN	BxB
7.	N-B3	Q-B3
8.	B-K3	B-K2
9.	N-Q5	QxQ
10.	NxQ	BxN
11.	PxB	0-0-0
12.	N-N5	P-QR3
13.	N-R7ch	K-N1
14.	0-0-0	N-B3

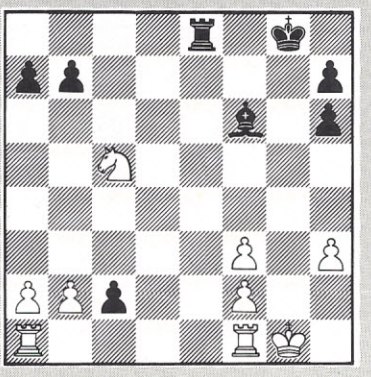
White: *Black Knight* Black: *Elsa*

15.	P-KB3	R(R1)-K1
16.	R(R1)–K1	B-B1
17.	R-Q2	RxB
18.	RxR	KxN
19.	R-Q1	R-Q2
20.	P-QB4	P-QN4
21.	PxP	PxP
22.	R-N3	K-R3
23.	R-R3ch	K-N3
24.	R-N3	P-N3
25.	P-QR4	B-R3ch
26.	K-N1	K-R4
27.	RxPch	KxP
28.	R-N7	R-K2
29.	R-Q3	R-K8ch
30.	K-R2	R-K6
31.	R-Q4ch	K-R4
32.	RxP	B-N4
33.	P-R4	N-K1
34.	RxP	B-B3
35.	R-K4	RxR
36.	PxR	BxRP
37.	RxP	

Adjudicated a draw

White: *BCP* Black: *Wita*

1. P-K4	P-QB4	35. K-K5	R (Q3)-K3ch
2. N-QB3	P-Q3	36. K-Q5	R (QB5)-QN5
3. P-Q4	N-KB3	37. R-N7ch	K-KB3
4. B-K3	P-K3	38. R-N4	R (QN5)xR
5. N-B3	B-K2	39. PxR	R-K4ch
6. P-K5	QpxP (K4)	40. K-B4	RxN
7. B-QN5ch	B-Q2	41. PxR	P-KR4
8. PxKP	N-N5	42. P-R4	KxP (KB4)
9. 0-0-0	N-QB3	43. P-R5	P-KR3
10. BxN	BxB (QB3)	44. P-R6	B-KB3
11. QxQ	R (QR1)xQ	45. P-N4	P-KR5
12. B-B4	0-0-0	46. P-N5	P-KR6
13. P-KR3	BxN (KB6)	47. P-N6	P-KR7
14. PxB	N-KR3	48. PxP	P-KR8=Q
15. BxN	P (KN2)xB	49. K-N3	P-KR4
16. N-K4	P-KB4	50. K-R4	Q-QB3ch
17. PxP (EP)	BxP (KB3)	51. K-R3	Q-QR1
18. NxP (B5)	R (Q1)-Q7	52. K-N4	B-Q5
19. NxKP	R (KB1)-K1	53. K-B4	K-K5
20. N-B5	R (Q7)xP (QB7)	54. K-N5	P-KR5
21. NxP (See Figure)	R (QB7)-QB2	55. K-B4	P-KR6
22. N-Q6	R (K1)-KB1	56. K-N3	P-KR7
23. QR-N1	B-K4	57. K-B4	Q-Q4ch
24. KR-Q1	R (QB2)-KN2	58. K-N4	P-KR8=Q
25. K-B1	R (KB1)xP (KB6)	59. K-R3	Q (KR8)-QR8
26. N-B4	B-KB3	60. K-N4	Q (QR8)-QR4 (MATE)



The lengthy game was to continue for another 40 moves. Surprisingly it ended in mate for WITA.

27. R-Q6	B-KR5	
28. K-K2	R (KB6)xP (KB7)	
29. K-K3	R (KB7)-QB7	
30. K-Q4	R (KN2)-QB2	
31. R-KN1ch	K-KB2	
32. N-K3	R (QB7)-Q7ch	
33. K-K4	R (Q7)xR (Q3)	
34. N-B5	R (QB2)-QB5ch	

Valenti's Chess Program - Part II

. *Mike Valenti*'s thesis on computer chess continues with the following short section on use of language for the computer:

A high-level language was chosen to write the chess program framework for a number of reasons. Basically, these are easy logic programming and debugging; easier structured programming; readibility; and, of lesser importance, data structure manipulation. Each of these items is discussed in turn below. (An IBM 370 series of computer was used for the program, and this discussion relates to the language processors available on that series of machines.)

Because the chess specific parts of this program (plausible move selection and heuristics) are mainly decision-making processes, logic debugging is important. A high-level language generally has a much better facility for representing this logic than does an assembler language. It also has fewer restrictions on the format of this logic in the program listing. Also, the expressions on which these decisions are based can usually be presented more clearly using a high-level language's features for testing flags or comparing items.

Structured programming is greatly facilitated by using a high-level language. Because ease of modification was a prime consideration, the successive refinement, in a hierarchical manner, of the problem of playing chess was done.

Most high-level languages allow the use of long descriptive names for variables, constants, and procedure names. This greatly increases a program's readability and understandability and helps keep necessary comments to a minimum. The particular language chosen also had a facility for replacing language keywords, such as "IF" or "DO WHILE", by more descriptive names. Some of the assembler level languages available had some of these features also, but the framework in which they could be used was more restrictive (such as only one statement permitted per line). Since the start of this program, however, some advances have been made in structured assembler programming, and it may now be more reasonable to choose an assembler level language for reasons of readability and understandability.

Of lesser importance was some way of representing and manipulating structured data. In this way, contiguous information representing a chess position could be referenced using meaningful names instead of subscripted variables.

The program was written in BPL which is an XPL dialect with modifications for multi-dimensional arrays, recursive procedures, controlled storage, and a basic structured data definition capability. The language is well-suited for a number of reasons, but it does have a few drawbacks.

It is not as powerful a language as, say, PL/I, but then it doesn't allow one to do many inefficient things that would generate slow code (for instance, complex "DO" statements and costly "CALL"s). Besides, having the necessary features discussed earlier, it also has a very high compilation speed relative to other high-level processors such as PL/I (including optimizer) or FORTRAN IV.

One of the drawbacks is that it does retain the XPL feature of rather poor diagnostics in certain cases, and BPL is poorly documented on its added features over XPL, and is also unsupported. Another drawback is its lack of

range checking, a quality which can be very useful in debugging. However, these weaknesses are easily outweighed by the extra speed and efficiency of the compiler and the code generated.

Another feature of BPL allows direct register manipulation which, when coupled with in-line assembler instructions attains very efficient code generation, if desired. These features have been avoided in this program for reasons of readability, and overly "clever" (fast but hard to figure out) programming has also been avoided for the same reason.

(A more detailed discussion of BPL will appear here, in a later issue. BPL is an extended version of XPL).

Software Dynamics Chess

. The following pleasant monologue was received from *Ira Baxter,* of Software Dynamics, author of *SD Chess:* "One might ask, 'Why would someone bother to write a chess program in something as arcane as BASIC?' The answer – how could I resist? Nobody believes it to be possible! *SD Chess* is a program written in SD BASIC, a compiler version of BASIC. The program can be instructed to play at different levels of skill, but has only two practical modes of play – blitz and dumb, due to time constraints.

"*SD Chess* was entered in the West Coast Computing Faire's Chess Tournament. It beat Mark Watson and Tenberg BASIC but lost to *Chess Challenger* and *CompuChess.*

"This note describes a little about the operation of *SD Chess,* and is mostly oriented towards the programming tricks and heuristics installed in the program. In the following discussion, I assume the readers are familiar with the fundamental operation of look-ahead logic on game trees that most chess-playing programs use. There is an excellent book on the subject, 'Chess and Computers' by David Levy, that is definitely worth reading.

"*SD Chess* operates by generating all the possible moves for White for a particular (parent) board position, making each move on the parent board (creating a daughter board) in turn, changing all White pieces to Black, and recursively applying the move generation logic again. Each of these 'make a move and switch piece colors' I call a single-'ply' lookahead. The program can look ahead up to 5 ply (the actual depth of lookahead is established by a conversation with the human player at the beginning of the game).

"The program stops looking ahead when it reached the maximum look-ahead level, and then applies a board evaluation function to determine the score for ('how good') the resulting position. The actual evaluation function at this point in time is simply the sum of the values of White pieces minus the sum of the values of the Black pieces, with a free point thrown to the appropriate side if that side has castled.

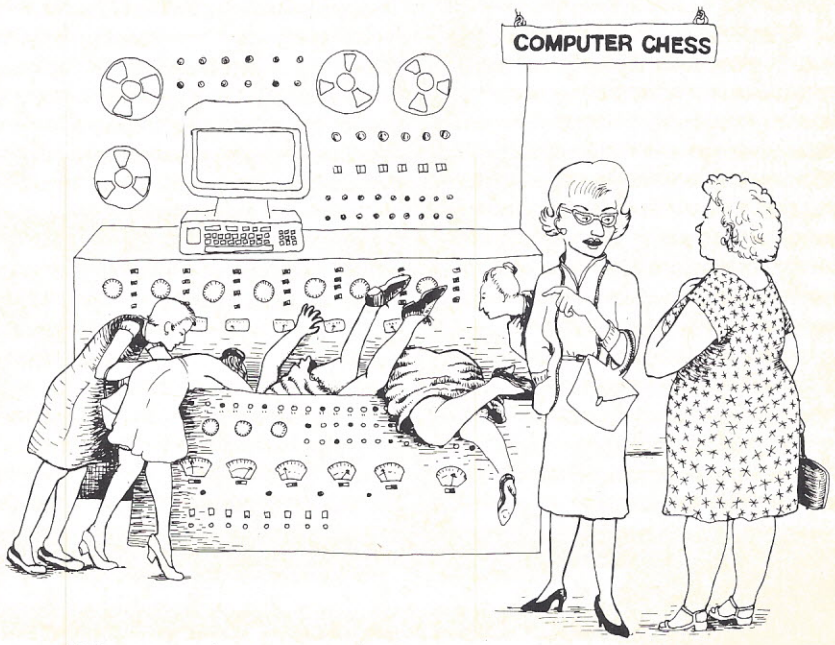
"The scores of the board positions resulting from moving pieces from a parent board B are then compared to obtain the maximum score (the heuristically 'best' move). The maximum score is then taken to be the score of board position 8.

"When passing scores up to a parent board, the negative of the score for the daughter board is used. This is because the daughter board actually was scored with White pieces swapped for Black (I also swap back).

"By passing these negated scores up the game tree and always applying a MAX function, I effectively cause a mini-max evaluation of the game tree. This process also eliminates the need for any move generating logic for the Black pieces.

"The lookahead is limited by a minimum and maximum value. The minimum lookahead guarantees that *SD Chess* will examine all possible legal moves to a certain depth. *SD Chess* will then continue looking deeper if the board position obtained at the minimum lookahead was arrived at by a capture move. This heuristic is used to make *SD Chess* examine capture sequences out to the bitter (or Max depth) end, so that it can see that taking your protected pawn with its King is a good way to lose, even if the pawn capture occurs at the minimum look-ahead depth.

"In an attempt to minimize the number of moves processed by *SD Chess*, the move generating logic retains only the highest-scoring capture moves when it is operating at the maximum depth; generally, a high-scoring capture



"They say there are midgets in there doing all the work!"

indicates a good refutation of a previous move, and by trimming the move list at the deepest level, we save the program an enormous amount of processing time, since the number of moves to process at depth N is roughly 30↑N (2700 for N=3).

"An Alpha-Beta pruning algorithm is used to prevent further search of sub-trees which are obviously fruitless. Since I have to evaluate only White board positions, the -Beta part of the pruning algorithm is not needed. Furthermore, the move generating logic sorts generated moves by descending value of score, to maximize the probability of the Alpha-prune occurring.

"The first version of the program had the sorting test backwards, which minimized the probability of pruning. This 'bug' was discovered by sheer introspection because all it did was slow down the program by a factor of 3, and I didn't know how fast the program would run!

"The most annoying effect I have yet encountered is what is called the 'horizon' effect, where the program fails to see that it is going to be in hot water. A typical problem this causes is the following: The program discovers the opponent can castle, no matter what the program does. So the opponent will gain 1 point. Now the program chooses a move which gives a pawn to the opponent for free (after all, if you're going to lose a point, it hardly matters which one you lose, does it?), because the lookahead maximum prevents the program from discovering that after it has lost the pawn the opponent can *still* castle (i.e., the program has parlayed a one point loss into a two point loss). Yuk! I don't know a general cure for this problem other than extending the horizon. I did cure this particular aspect by scoring castling slightly less than a pawn.

At the top level of move evaluation (i.e., ply 0), *SD Chess* selects moves which move toward the enemy king if all other things are equal. This provides *SD Chess* with the long-range goal of 'get near the opponent's king'. It also provides P - K4 as a standard opening for free.

"*SD Chess* also attempts to minimize the opponent's mobility (all other things being equal). This is supposed to help trap the enemy king in the late endgame, but I've never seen any evidence of it helping. The only other interesting characteristic of the implementation of *SD Chess* is a programming trick. *SD Chess* stores the chess board (8 by 8) in the middle of a 12 by 12 field, with the borders filled with White pawns:

```
P P P P P P P P P P P P
P P P P P P P P P P P P
P P                   P P
P P                   P P
P P                   P P
P P                   P P
P P                   P P
P P                   P P
P P                   P P
P P P P P P P P P P P P
P P P P P P P P P P P P
```

"This trick considerably simplifies the move logic since any generated move of a piece lands somewhere inside the 12 by 12 board. Since the move generator must already check to make sure that a piece does not move onto a square occupied by a piece of the same color, it will reject any attempt to move off the edge of the 8 by 8 playing area because the moved piece would then land on a White pawn. This means the 'did the piece move off the edge of the board?' check is done for free, and results in a considerable savings. The program has no opening move sequences stored, so it does absolutely no 'back' play.

"Last but not least is, how well does the program play? At blitz level, it plays at a level comparable to the Randy Miller chess program (written in Altair [TM] BASIC) using about 1 second of CPU per move while the Miller program takes some 3-4 minutes to do a poorer job (Miller's program goaded me into writing *SD Chess* because it was impossible to improve his).

"At the level which I play it (1-5 minutes a move, because I haven't the patience to wait longer), it is short enough to discover sequences in which it can safely make off with your piece, to discover it has been checkmated, and to prevent a threatened mate with a simple counter-move. During one freak game I played with it, it used a tolerably good version of the Ruy Lopez opening. It seems to be clever enough so you can't beat it with one arm tied behind your back, and sometimes wins because its exhaustive search never overlooks a combination you didn't notice. This is the level I expect it to play in tournaments.

"The biggest lesson learned from this program is that one apparently needs enormous amounts of processing power to play chess well this way. No wonder *Chess 4.6* does well, it has a CDC 176 behind it! I fully expect *SD Chess* to be beaten by assembly language programs simply because of the extra analysis an assembly program can invest in the same amount of time *SD Chess* has spent analyzing. (I note here that *SD Chess* is compiled to 'pop code', which runs 10-60 times faster than conventional BASIC interpreters and some 10 times slower than assembly language programs doing all 16-bit arithmetic.) My next optimization is to really compile the beast to machine code. But a compiler that can do it isn't yet available.

"One more comment. It seems that since microprocessors lack computing power so miserably, perhaps we should run microprocessor Chess tournaments by mail, with an allowed overnight turnaround to make a single move. I'd bet this would considerably improve the games these beasties play.

"*SD Chess* can be obtained from Software Dynamics, 17914 S. Laurelbrook Pl., Cerritos, CA 90701. It requires the SD RUNTIME Package, and runs on 6800 CPUs with at least 32K bytes of memory. SDRUN + SDCHESS together cost some $125. Most people buy the SD BASIC Compiler system and get *SD Chess* as a demo program."

Why would someone bother to write a chess program in something as arcane as BASIC?

Seattle's Third Round

. Leading in the standings at the end of Seattle's second round were *Chaos, Chess 4.6* and *Duchess,* all with two wins each. *Black Knight, Blitz V, Ostrich, Tyro, Xenarbor* and *8080 Chess* had one win apiece. The other participants *(Chute 1.2, Wita* and *Brute Force*) began the third round of the tournament still looking for their first win. The six games of round three, with the 12 participants, follow. Anticipation mounted with each game.

		White: *Tyro*	Black: *Chute*		
1. P-Q4	P-Q4			23. K-R1	PxP
2. P-QB4	P-K3			24. QxP	B-Q3
3. P-KN3	PxP			25. Q-B3	R-KN1
4. N-KB3	N-QB3			26. R-KN1	RxRch
5. P-QR3	N-B3	14. B-N4	P-KB4	27. RxR	Q-K4
6. N-B3	P-QR3	15. KPxP	Px8P	28. Q-N2	K-Q2
7. P-K4	P-QN4	16. B-B3	B-N2	29. R-Q1	B-B4
8. B-KB4	N-KR4	17. 0-0	Q-N3	30. R-Q2	Q-K8ch
9. B-R3	NxB	18. QR-K1	P-R3	31. Q-N1	QxR
10. PxN	Q-B3	19. Q-K3	Q-KB3	32. Q-N7ch	B-K2
11. Q-Q2	Q-R3	20. N-K6	R-QB1	33. Q-K5	QxBP
12. N-N5	N-Q1	21. NxN	KxN	34. Q-K6ch	K-Q1
13. P-Q5	B-K2	22. B-R5	P-N4	35. QxKRP	Q-B8mate

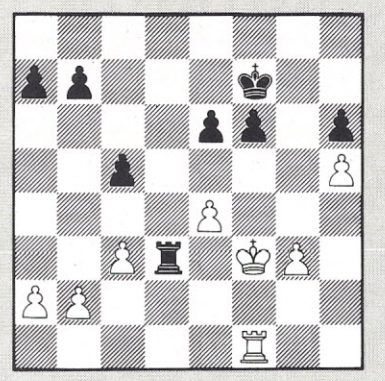
		White: *Black Knight*	Black: *Xenarbor*		
1. P-K4	P-QB4			31. N-B6ch	K-R1
2. N-KB3	N-QB3			32. N-K7	P-B5
3. N-B3	P-Q3	17. KR-Q1	B-K4	33. R-N8	RxR
4. P-Q4	PxP	18. B-Q5	BxB	34. P-B4	R-N8ch
5. NxP	NxN	19. NxB	BxRP	35. K-B2	P-B6
6. QxN	N-B3	20. R-KR3	B-K4	36. N-B8	K-N1
7. P-K5	PxP	21. P-KB4	P-KR4	37. N-N6	P-B7
8. QxKP	P-QR3	22. PxB	PxP	38. N-Q7ch	K-R2
9. B-K2	Q-Q3	23. R-KB3	P-B5	39. N-K5	P-B8=Q
10. QxQ	PxQ	24. P-KN3	PxP	40. K-B3	P-R6
11. B-KN5	B-K3	25. RxNP	P-R5	41. P-B5	P-R7
12. BxN	PxB	26. R-N7	P-B4	42. P-R4	P-R8=Q
13. B-B3	0-0-0	27. N-N6ch	K-N1	43. P-N4	Q-R8ch
14. 0-0-0	B-R3ch	28. R/1-Q7	RxR	44. K-Q3	QxN
15. K-N1	B-N2	29. NxRch	K-R2	45. P-R5	Q/8-K5ch
16. R-Q3	P-B4	30. NxP	R-K1	46. K-Q2	Q/4-Q5mate

		White: *Chess 4.6*	Black: *Chaos*		
1. K4	P-QB4			19. R (B7)xBP	KR-N1
2. N-KB3	N-QB3			20. Q-K3	QxP
3. B-N5	N-B3	11. N-B4	Q-Q1	21. R-B7	BxN
4. P-K5	N-Q4	12. N-Q6	Q-N3	22. RxB	B-R6
5. 0-0	P-K3	13. P-B4	QxP	23. Q-B4	P-B4
6. BxN	QPxB	14. PxN	BPxP	24. PxPe.p.	B-B1
7. P-Q3	B-K2	15. KR-N1	Q-R6	25. PxP	B-K2
8. N-R3	0-0	16. RxP	Q-R5	26. RxB	P-KR3
9. B-Q2	B-Q2	17. R-QB1	QR-N1	27. Q-B7ch	K-R2
10. Q-K2	Q-N3	18. R-B7	R-N7	28. P-N8=Qmate	

		White: *Blitz V*	Black: *8080 Chess*		
1. P-K4	P-K4			11. PxP	QxNP
2. N-KB3	P-Q4			12. QxPch	K-Q1
3. NxP	PxP			13. QxB	BxPch
4. B-B4	N-KR3			14. QxB	QxR
5. 0-0	N-B3	8. P-Q3	B-B4	15. Q-R4ch	K-Q2
6. NxN	PxN	9. BxN	PxB	16. R-Q1ch	K-K1
7. Q-K2	B-KB4	10. Q-R5	Q-B3	17. Q-R5ch	resigns

White: *Ostrich* Black: *Duchess*

1.	P-K4	P-K4	25.	B-B4	R-Q1
2.	N-KB3	N-KB3	26.	N-K5	NxN
3.	B-B4	NxP	27.	BxN	B-B3
4.	Q-K2	P-Q4	28.	BxB	PxB
5.	NxP	B-K3	29.	R-KB1	K-N2
6.	0-0	B-Q3	30.	K-N2	K-B2
7.	N-KB3	0-0	31.	K-B3	R-Q6ch
8.	P-Q3	PxB	32.	K-N4	R-Q7
9.	PxN	N-QB3	33.	R-QN1	R-KB7
10.	N-N5	N-Q5	34.	P-R4	K-K2
11.	Q-R5	P-KR3	35.	P-N4	P-B5
12.	NxB	PxN	36.	R-K1	R-QB7
13.	Q-Q1	P-B4	37.	R-K3	P-N3
14.	P-QB3	N-B3	38.	P-R5	PxP
15.	N-R3	Q-N1	39.	PxP	K-Q3
16.	P-R4	N-K4	40.	K-B4	R-QR7
17.	B-K3	B-K2	41.	R-B3	RxP
18.	P-KB4	N-Q6	42.	K-K3	K-K4
19.	NxP	NxP	43.	R-B2	R-Rb
20.	P-KN3	N-N3	44.	R-B2	R-K8ch
21.	Q-N4	K-R2	45.	K-Q2	RxP
22.	P-R5	N-K4	46.	R-B1	R-N5
23.	RxR	NxQ	47.	R-K1ch	K-Q4
24.	RxQ	RxR	48.	Resigns	



An evenly-played game through the first 30 moves. Same number and same values of pieces have departed. The first break in the game comes with the initial check of White at move 31 (See Fig.).

WE'RE PUTTING OUR SHOW ON THE ROAD

South Carolina Byte Shop now has a DATA BUS, outfitted with our preferred lines of computer equipment and an "audio-visual road show". Our idea is very simple. The small computer market is flooded with dozens of manufacturers and hundreds of machines. Through testing and experience in sales and service, we have selected several preferred lines of equipment that actually do what their advertising claims they can - and do it very reliably.

Now we're ready to share what we've learned with our customers. If your business or group is interested in having our DATA BUS visit your area - or if you want us to add your name to our mailing list - call or write us...



BYTE SHOP #32
the affordable computer store
2018 Green Street
Columbia, S. C. 29205
771-7824

CIRCLE 14

		White: *Brute Force*	Black: *Wita*		
1. P-Q4	N-KB3			23. PxP	BxP
2. N-QB3	N-B3			24. P-R4	P-KR4
3. P-Q5	NxP	13. K-Q1	N-B7ch	25. P-R4	P-R5
4. QxN	P-Q3	14. K-K1	NxRch	26. R-R4	B-K3
5. P-QR3	P-K3	15. P-N3	NxP	27. B-B2	P-R6
6. Q-Q2	B-K2	16. Q-Q3	Q-B3	28. P-K3	P-R7
7. P-QN4	B-B3	17. NxB	QxN	29. B-N3	P-R8=Qch
8. P-N5	N-K4	18. Q-B3	P-Q4	30. K-K2	Q-QB8
9. P-B4	N-N5	19. Q-N4	QxQ	31. K-Q3	R-QN1
10. N-B3	P-B3	20. PxQ	NxB	32. P-K4	R-N7
11. PxP	PxP	21. KxN	P-QR3	33. R-R3	RxP
12. P-R3	B-R5ch	22. B-K3	P-K4	34. N-R2	O-Q7mate

Machine ratings

. A note from *Doug Penrod:* "I believe there should be some sort of rating for the dedicated machines like the Chess Challenger, CompuChess and Boris. It would be a good idea to get rated players to play these machines in order to arrive at a rating. One problem in rating machines is that people hear about the machine's characteristics and play like a human would play another human in a match – study their games and take full advantage of them. But in general this can't be done in a human tournament, because players don't know who their opponents will be ahead of time. It would be fair, and certainly more instructive, if a human player never knew what machine he was playing against. This can easily be arranged from a technical point of view – just have another human enter the moves remotely and have a third human handle the machine out of sight somewhere, like on the other end of the telephone. In fact, the player need not even know that he is playing a machine at all. This will prevent him from 'cheating' by taking advantage of previously known information about the machine, an advantage he would not ordinarily have playing a human in a tournament which determines the ratings of the players."

INTRODUCING COMPU-KIT®



Finally, the one tool kit designed especially for home computers. From assembling kits to servicing existing equipment, this set of tools is the most comprehensive of its kind on the market.

This fine kit includes such tools as: wire wrapping tool, snap ring pliers, screwdrivers, nutdrivers, soldering iron, and much more. All of the tools are top quality, manufactured by such companies as: Xcelite, Weller, Utica, and Proto. The Compu-Kit® is available with or without a Triplet 310 V.O.M.

Compu-Kit $159.00
Compu-Kit with V.O.M. $214.00

Compu-Kit Division V.S.I. Corporation
P.O. Box 20847 Dallas, Texas 75220
Phone: 214/358-1414

To order — send check or money order, or charge to your Master Charge or Visa card.

☐ I've enclosed check or money order in the amount of $_____

☐ Master Charge ☐ Visa
Account Number (all digits)

Inter Bank Number

Signature _____

DEALER INQUIRIES INVITED

CIRCLE 15

Micro-Chess Tourney

. The first annual Micro-chess tourney will be held in Louisville, Kentucky in August of 1978 and they are scurrying around getting ready for the big event. To put on a really fair tournament they are in the process of drawing up the rules and regulations now.

- Competition limited to approved 8-bit micro-processors, no bit slice machines will be allowed. (But other microprocessors will be considered. Send request with SASE to address below.)
- Programs can be in either machine language or a higher level language.
- 16K 8-bit words memory maximum. (9 bits if parity is used.)
- Home-brew machines and commercial machines allowed.
- Top three winners software published through leading magazines.
- Machines may be loaded from any media but after the program is operating the laoding device must be detached.
- A panel of judges will rule promptly on program crashes or other unexpected problems.
- Competition will be timed.

For further information write: Louisville Area Computer Club, 3028 Hunsinger Lane, Louisville, KY 49220. Or phone: (812) 283-4128.

Needs Information

. *D.A.L.A. Whitehead* of 29 Hulbert Rd., Waterlooville, Hampshire, England became interested in computer chess after reading an article in *Practical Wireless,* an English electronics construction magazine. "I am a student studying A-levels and part of my curriculum is computer studies," he writes. "I have devised many programs for playing games such as Tictactoe, etc. But I have not attempted anything as complicated as a chess playing program and would be interested in receiving information and samples of these programs."

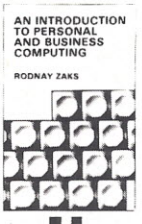
TELOS and GO

. *Bill Wickert,* University of Wisconsin, Dept. of Computer Science, Madison, WI 53706, "I am interested in computer chess. Currently I am a graduate student under Larry Travis here at the university. My present project is a chess-playing program written in TELOS, and extension of PASCAL, which is being developed for AI use. If and when my partners and I get this monster to play half decently, I will send you details. Is anyone out there interested in computer GO?

Computer Chess Seminar

David Slate and *Larry Atkin,* co-authors of world-champion *Chess 4.6* will conduct a seminar in computer chess in Chicago, Oct 5-8, during Personal Computing's 2nd annual Midwest Exposition.

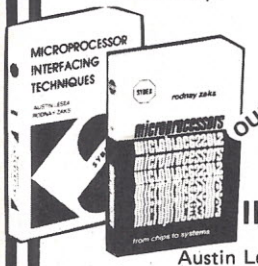
NEW



AN INTRODUCTION TO PERSONAL AND BUSINESS COMPUTING

Rodnay Zaks - Austin Lesea Ref C200 **$6.95**

This introductory text is aimed at answering the basic question: "What do I need in order to...?" It covers applications, peripherals, existing systems, how to assemble them. How to choose. The real cost of a system. The software. Is a floppy sufficient for a mailing list? Build or buy?



OUR 2 BESTSELLERS

USED WORLDWIDE IN TEACHING AND EDUCATION

MICROPROCESSORS

Rodnay Zaks 416 pp., ref C201 **$9.95**

MICROPROCESSOR INTERFACING TECHNIQUES

Austin Lesea – Rodnay Zaks 416 pp., ref C207 **$9.95**

TO ORDER

- **BY PHONE:** call (415)848-8233 BankAmericard/Mastercharge accepted
- **SHIPPING:** no charge when payment included.
 ADD: $1.00/book for fast shipping.
- **TAX:** in California, add sales tax.
- **OVERSEAS:** SYBEX-EUROPE,313 rue Lecourbe, 75015 - PARIS, France Tel:(1)8282502

SYBEX

2020 Milvia St. Berkeley, Calif 94704

MICROPROCESSOR LEXICON **$2.95**

110 pp., pocket-size, ref X1

ALL THE DEFINITIONS AND ACRONYMS

A complete dictionary, PLUS: part numbers, signals, for S100. RS232, IEEE 488, addresses.



SELF-STUDY COURSES

Each course includes a book plus 2 cassettes (can be played on any cassette recorder at home, in the car, at the office.)

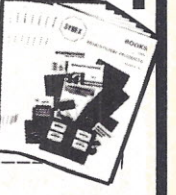
S1-INTRODUCTION TO MICROPROCESSORS **$29.95**
2½ hours. Basic introductory course.

S2-PROGRAMMING MICROPROCESSORS **$29.95**
2½ hours. Basic introduction to programming.

A MICROPROGRAMMED APL IMPLEMENTATION **$25.00**

Rodnay Zaks 320 pp., ref Z-10

The complete design of a real APL interpreter, including theory, parsing, operators, dynamic block management, actual listing.



NAME _____ POSITION _____
COMPANY _____
ADDRESS _____
CITY _____ STATE/ZIP _____
☐ C201 ☐ C207 ☐ C200 ☐ X1 ☐ Z10 ☐ OTHER _____
☐ Payment enclosed ☐ Bill company ☐ Bill me
ADD $1.00 / BOOK FOR FAST SHIPPING
☐ charge my ☐ Visa ☐ Master charge
☐ Number _____ Exp date _____
Signature _____ ☐ Send catalog.

☐ FREE CATALOG/ ORDER FORM ☐

The Apple II microcomputer

Apple II personal computer system from Apple Computer, Cupertino, CA is ready for use the moment it's unpacked. Assembled and pre-tested, Apple II can be connected to any standard television set using an inexpensive (about $12) RF modulator.

Your television screen becomes Apple II's output, displaying alphanumeric characters and video graphics in up to 15 colors. Input to Apple II is through an alphanumeric keyboard built in to the case.

A single printed-circuit board contains the microprocessor, system memory (up to 12K bytes ROM and 48K bytes RAM) and other electronic components and interfaces. Apple II also contains video display electronics to work with your television set, an ASCII keyboard, an interface to a standard audio cassette recorder/player (for storing and loading programs), an I/O connector (for paddles and other interactive game controls) and a speaker and connectors for up to 8 peripheral boards. One handy feature is Apple's built-in software.

Designed for novices as well as experienced hobbyists, Apple II has BASIC stored in 6K bytes of ROM for fast access and execution. You can use Apple II's BASIC to write your own video action games.

Apple II's integer BASIC contains numerous extensions designed specifically for personal computing applications, including COLOR, PLOT, HLIN (draw horizontal line), VLIN (draw vertical line), SCRN (x,y) (reads screen color) and PDL (game paddle read function).

Apple II displays memory as text (24 lines of 40 characters), color graphics (40 wide x 48 high in 15 colors) or high resolution graphics (280 wide x 192 high in four colors – black, white, violet, green).

In both graphics modes, four lines of text may optionally be displayed at the bottom of the screen, allowing you to give game instructions, label graphics, or have the computer ask you questions.

All display modes are software selectable using BASIC commands. In addition, one of the two memory blocks can be selected for display, allowing you to instantly switch between two previously stored screen images.



Apple II measures 18" x 15.25" x 4.5" and is made of molded plastic. For future expansion, eight peripheral slots allow addition of new peripherals as they become available. The computer is not compatible with S-100 boards; only Apple boards are compatible.

Programs can be stored on and retrieved from standard audio cassette recorder/players by means of a 1500-bps cassette interface.

Apple's switching power supply weighs 2 lbs. and requires no fan.

Minimum memory configurations consists of 4K bytes RAM (for user program and data storage) and 8K bytes ROM (6K for BASIC and 2K for the monitor program). The 2K monitor provides debug commands, a mini-assembler, disassembler, single-step and trace routines, floating point package, and a software-simulated 16-bit arithmetic capability. Full cursor control. scrolling and screen protection (a good feature) are also supported.

Manufacturers say applications include using the computer as a teaching aid for students and for entertainment through interactive games. Color displays can be created with the color graphics commands.

Paddles and joysticks can be interfaced using the built-in GAME I/O connector. The BASIC command (PDL) senses the position of the paddle to simplify writing action games. A built-in speaker sounds when the ball is hit or a photon torpedo is fired at the Klingons.

Manufacturers also suggest home business applications such as financial and bookkeeping analysis, charting the Dow Jones averages and home budget tracking.

According to manufacturers, when the Apple II is equipped with soon-to-be-announced added components, it will be able to monitor home systems such as heating and cooling, burglar alarm, fire and smoke detectors and lighting. When you're away, the computer can randomly light different parts of the house on different days to give the appearance that someone is in residence. Outside the home, Apple II can water the lawn and turn on and off security lighting. Also, the computer will monitor these systems and compo-



nents to ensure all are operational, manufacturers say.

With two game paddles and a demonstration cassette, the Apple II costs $1298. A 16K version costs $1445. In board form only, without case, keyboard, power supply or accessories, the computer costs $798.

Recently announced peripherals include an Intelligent Communications Interface (model number A2B0003X) for $180 and the model A2B0002X Intelligent Printer Interface card for $180.

In June, Apple will begin delivery of their floppy-disk system, the first of a series called Apple Intelligent Subsystems. It's estimated to cost under $700 for single drive and controller. A finance package for personal and small business use should be available in June.

Other options under development include serial I/O board, parallel I/O board, music synthesis system, PROM programmer board, prototyping board and isolated power controller.
Circle No. 166

Ticker tape parade...

A new ticker tape machine based around a microcomputer has been introduced. The device was baptized Tickertec at birth and the proud parents (Intersystems Software) say it's the latest innovation in stock market reporting. Tickertec's biggest selling punch is that it's well suited, by price, for the individual investor. Now, a small time shopper on Wall Street, with a device like this installed in his living room, next to the TV, can watch the latest stock market quotations and keep his eye on a televised baseball game at the same time. It's that easy, now, to make a buck.

The unit is a completely self-contained microprocessor-controlled advanced stock ticker machine. The device connects directly to the New York Stock Exchange low speed ticker line (current or 15 minute delayed) through Western Union's communication lines.

Tickertec allows the user to specify ticker symbols of various stocks of interest. For each of these stocks the system will perform the following: report last traded price, last traded volume, and total volume traded; indicate the market originating last trade, maintain a history of previous nine trades, report whenever a stock has gone outside price limits imposed by users, display current stock ticker as it is being processed, display last half-hourly report, display last announcement to come across the ticker and give you an opportunity to get out of your chair during the seventh-inning stretch and go to the bar in the den. There you can mix your favorite drink and reflect on the pleasures of getting rich at your leisure.

While you're busy at the bar, you need not worry about Wall Street. You may miss an inning or two of the baseball game, but your machine won't lose a single "tick". It's designed to read the stock ticker constantly – never losing any character transmitted to the device, the manufacturer says.

The basic system stores information on 240 ticker symbols. Special orders to store more symbols, or to maintain a history of more than the last 9 trades, can be easily handled.

The Tickertec system includes a CRT for interactive communications with your monitor. Entry is through simple one or two letter commands, which proves you don't have to know a thing about programming to run the computer. It's so simple you can even get your Basset to push one of the buttons and get the latest quotation on dog biscuits. When correct buttons are pressed, the screen lights up with the information you're seeking.

As an additional option you can have a printer deliver an image of the ticker display or give you selected trade information which you can bring to your analyst.

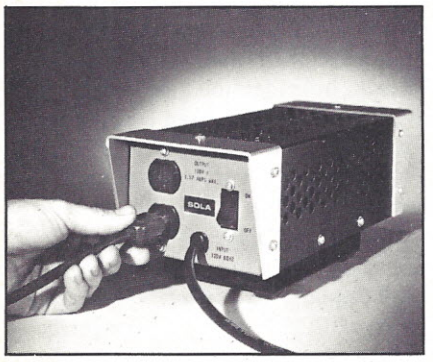
Time of the last trade and a plus/minus tick indicator for each monitored stock may be included – also at an additional price.

The price, by the way, for this machine is $5995. But you can make that back in just one afternoon of smart trading. Circle No. 167

For more information write: Intersystems Software Inc., 42 Manors Dr., Ref: PC, Jericho, NY 11753.

Systems, Subsystems, Software

Sola Electric of Elk Grove Village, IL, has a new series of **regulators** in its catalog. Designed to reject two types of of noise affecting electronic equipment, these regulators provide transverse-mode noise attenuation of 60 dB in addition to common-mode noise attenuation of 120 dB. Sola says these regulators exceed performance ratings of conventional ultra-isolation transformers and add voltage regulation, overvoltage protection and short-circuit current limiting as well. The Sola units, adds the company, guard data processing and other sensitive electronic equipment against virtually any AC

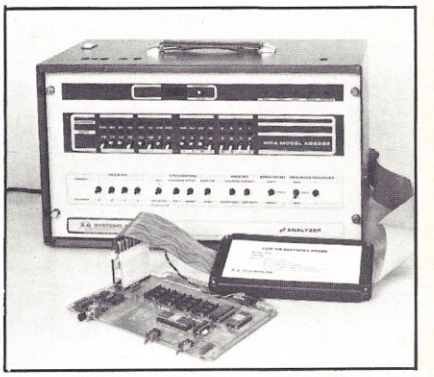


power problem except total blackout. The regulator series includes two 60 Hz models with 140 and 250 VA load ratings to accommodate low-power devices such as CRT terminals, point-of-sale systems, word processing equipment and energy management instrumentation. Prices begin at $170 for the 140 VA model. Circle No. 101

A redesigned **low-power timer** has been introduced by Exar Integrated Systems of Sunnyvale, CA. Called the XR-L555 Micropower Timer, the new integrated circuit has only 1/15th the power dissipation of the company's companion model, No. 555. By reducing the requirements for power supply level, the timer opens up new design possibilities in portable or battery operated applications, say Exar. Some of the features of the new circuit are pin compatability with the standard 555, power dissipation of less than 1 mW, timing from microseconds to minutes, 1000-hour operation with two NiCd batteries and compatability with CMOS, TTL and DTL. Typical applications of the XR-L555 are said to be micropower clock oscillator, battery operated timing, pulse shaping and detection, micropower PLL design assist, missing pulse detection, power-on reset controller, pulse-width or pulse position modulation, appliance timing and remote-control sequencing. Price for the plastic unit, in quantities of 100, is 90 cents. A ceramic model is also available. Circle No. 102

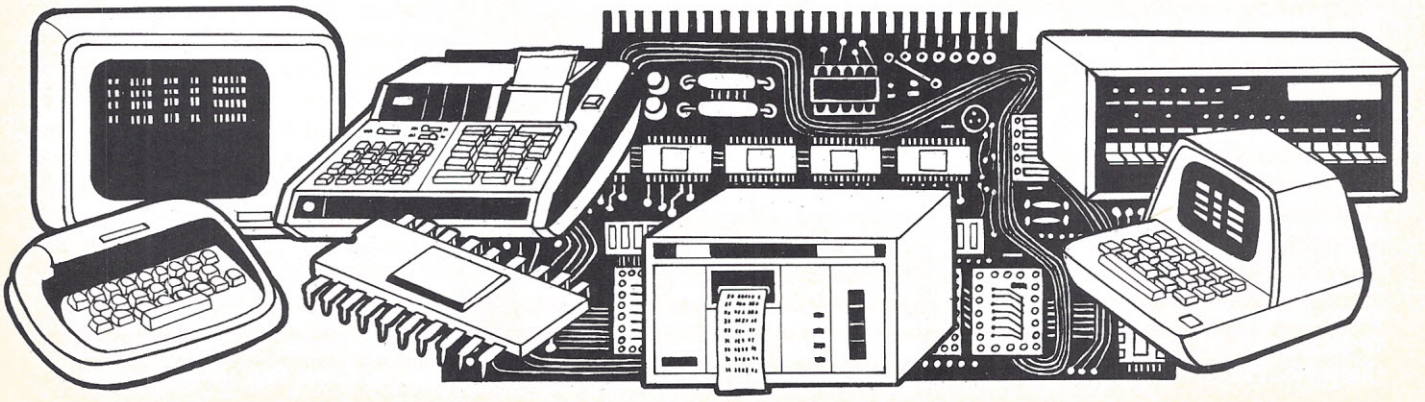
A low-cost TR 1983 **bus-oriented UART** is now available from Western Digital. The asynchronous 1983 provides a realistic, low-cost alternative to more expensive products, and is compatible with its 8251 UART, says the company. The TR 1983 has a generalized computer interface control, 28-pin package pinout, features full or half duplex operation and is powered by a single +5 volt supply. The company says it is currently accepting sample and production orders. Circle No. 103

A **buffered probe** that extends the capabilities of the AQ6800 Microprocessor Analyzer to 6802 microprocessors is available from AQ Systems, Inc. With the PRB68/02 probe, the AQ6800 displays address, data and status information of 6802 microcomputer sys-



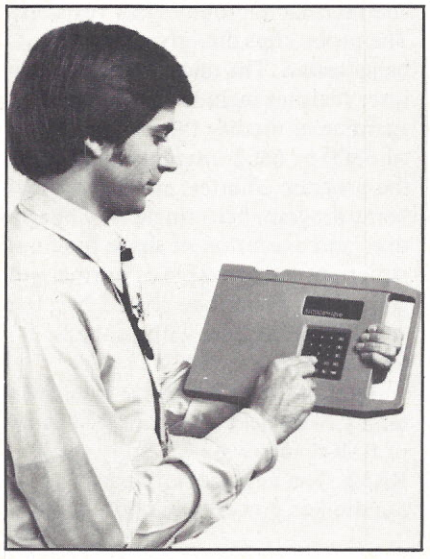
tems and provides direct user interaction with memory locations, I/O ports and internal microprocessor registers. The probe clips directly to the chip being tested. The microprocessor analyzer features include the ability to examine or modify the contents of all 6800 or 6802 internal registers plus the program counter, manual or breakpoint program halt, single step operation, and execution of single byte instructions independent of normal program flow. The probe costs $295; the AQ6800/02 system with probe is $1950. Circle No. 122

Intel of Santa Clara has enlarged its family of devices with the 2141 series of HMOS 4069 x 1-bit, fully **static RAMs.** The new memory packages require less power than conventional



MOS static RAMs and are designed for most main, cache, buffer and control store memory applications. Seven types in the series include four speed versions and three low-power selections. Maximum access times range from 120 to 250 nanoseconds. Minimum cycle times equal maximum access times. All seven devices use a single +5 volt, ±10% power supply and are directly compatible with TTL on all inputs and outputs. A fully static RAM, this 2141 chip permits use in either synchronous or asynchronous memory systems, allows data throughput to be maximized by the use of equal access and cycle times and requires a small power supply from 40 to 70 mA maximum. Prices for Intel's 2141 family start at $18.75 in quantities of 100-999. Circle No. 104

A low-cost source **data entry terminal** is a new product from Azurdata, Richland, WA. Named "ScorepadLC", the unit incorporates a charge-coupled device memory (CCD). Besides allowing



for a normal "product code" field of 4-12 characters and a "quantity" field of 0-8 characters, ScorepadLC allows any line or field to be opened up to accommodate free-form comment lines, or all entries to be free of formatting restrictions. More than 27,000 useful option configurations for formats, check digits and transmission codes can be selected through keyboard entry. ScorepadLC is available with 4K to 8K characters of CCD memory. Circle No. 111

Burroughs' new **audit and data entry system** prepares business data for computer processing. The AE 111 complements Burroughs' AE 400 and AE 500 systems and is suitable for financial, retail, wholesale, manufacturing and governmental applications. The system captures and prepares data for computers using magnetic tape cassettes as input.

The AE 111 consists of a data input unit using a standard numeric ten key pad, specialized data entry function keys, a 16-character Self-Scan display and a 16-character audit printer. A free-standing magnetic tape cassette drive provides program input.

System buffering of the keyboard, printer and tape cassette provide continuous data entry, printing and recording. Data records may be written to the cassette programmatically in single or blocked formats. From 1 to 124 characters with up to 34 varying data fields are available for each data record.

Price is $2,500. Circle No. 129

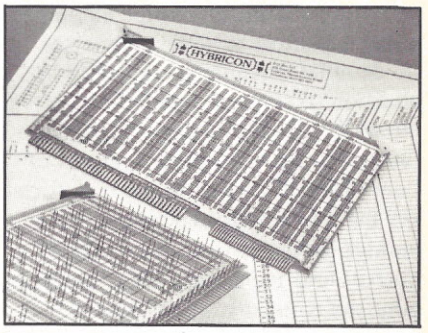
PolyMorphic Systems now offers a second edition of **system software** for its line of System 88 microcomputers. The new software includes enhanced operating software, BASIC, text editor and assembler.

Added to the BASIC language are string arrays and array commands allowing the user to create and manipulate such items as labels for tables and charts, mailing lists, personnel records, inventory and billing. For scientific users, BASIC now has inverse trig, hyperbolic, gamma and statistical functions.

The System 88 text editor now permits users to move, copy or delete entire blocks of text. This "cut-and-paste" technique eases large-scale reorganization of text (including program), the company says.

According to PolyMorphic, System 88 owners can upgrade their microcomputers by purchasing two copies of the new system disk for $25 and by changing 2K of ROM for $50 (free if they return the old ROMs). Circle No. 125

Hybricon, of Littleton, MA, has introduced a high density, microprocessor **Wire Wrap panel** compatible with the Intel SBC 8010. Model 2-8010A panel features 62 rows of 52 contacts, each on a 0.100" x 0.100" grid pattern with plated thru holes capable of mounting any combination of IC DIPs from 8 to 40 pins. Also incorporated in the panel are two ground planes and ten independent power buses for in-



termixing and operating various analog and digital combinations. The company offers an optional documentation kit which includes an assembly master, hole location grid, and parts list for use as design and layout aids. Price is $92.50 and the unit is available pre-pinned in the I/O, power and ground locations. Circle No. 110

An **Image Display System** from De Anza Systems, Inc., provides storage and display of a 256 x 256 bit image array with 6, 8 or 12 bits per pixel (element) in gray shades or color. Graphic modes and an alphanumeric generator are included for line drawings and annotation. The ID 1000 system includes the interface to PDP-11 Unibus or LSI-11 Q-Bus with interfaces available for other mini-computers. The price of $3,500 includes interface, 16-line by 16-character annotation area, 6-bit DAC and video generator for RS170-compatible output, power supply and chassis. A color system including the above items costs $4,100. Circle No. 124

A **compiler** from Information Access Systems helps compile, edit and run business applications on PDP-11 computers with at least 40K bytes of memory. Developed as a feature of the DIBEX operating system, the compiler enables users to program in, or to use existing DIBOL routines, for accounting, payroll, word processing and other business-oriented applications. Compiling and editing can be carried out at any or all terminals while the user continues to run his business applications on three, four or more other

terminals, the company says. Circle No. 126

Educational Data Systems offers an RT-11 compatible **software driver** for its MIGHTY-MUX 11L, DMA, serial line multiplexer. EDS's package supports full duplex asynchronous I/O for up to 128 ports on the multiplexer simultaneously. In addition, control requests determine port status, set port characteristics (baud rates, parity and so forth), assign logical/physical port mapping and abort I/O requests. The driver functions with any V02 system and comes free to users of the EDS MIGHTY-MUX 11L. Circle No. 127

Space Byte markets **Modular Business Computers** complete with application software for $5,900. The computer was designed for first time users as well as those with prior computer experience and features complete operator prompting and transparent file maintenance, the company says.

Bizpak application software is a report-generating system written in assembly language for the Space Byte 8085 CPU. Features include inter-

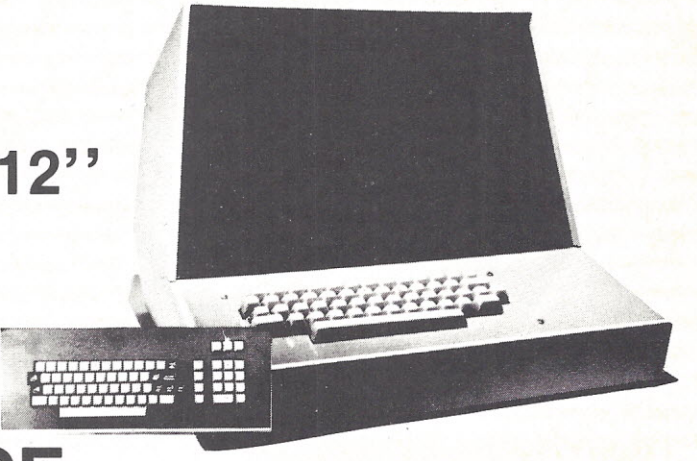


active program modules for accounts payable/receivable, payroll and general ledger. The package requires 16K of memory and comes with iCOM FDOS III operating system. Additional software includes disk extended BASIC, CP/M and FORTRAN-80. System hardware consists of the SB85-16 terminal mounted mainframe, Space Byte 8085 CPU, 16K fully static RAM, Hazeltine 1500 video display terminal, iCOM 3712 dual flexible disk drive and floor stand. Circle No. 123

GNAT-PAC System 9, which combines the **GNAT Microcomputer System** with dual standard floppy disk drives, offers up to 1 megabyte and is suited for small business applications, communications or process control, the company says. Hardware includes 8080A CPU, 32K RAM, 16K ROM board with 2K PROM, 4 RS232 serial I/O ports and floppy disk controller. Dual disk drives provide 500K disk storage and are expandable to 1 megabyte. The System 9 comes in a 10½" cabinet and includes card rack, fan, 11-slot motherboard, FRI line filter, wir-

TURNKEY SYSTEMS
Priced from only $5,000.00

Systems Include
THE VERSATILE CRT 12"
Software Printer
& Dual Floppy



THE MICRO FORCE
3315 Woodward Place
Raleigh, N.C. 27607
919-782-3390 9-7 M-F

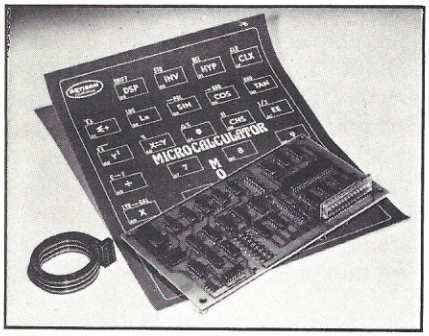
master charge
BANKAMERICARD welcome here

Dealer Inquiries Invited

CIRCLE 16

ing and power supply. Standard software includes a monitor, loader, disk operating system with assembler, editor and dynamic debugger including trace, test and debug. FORTRAN, BASIC and other high level languages are available. Price is $5500. Circle No. 120

A new **microcalculator**, Model 85, by Artisan Electronics of Parsippany, NJ, is designed for use with 8-bit microprocessors. The calculator interfaces with the micro through a bi-directional I/O port. Each entry that would normally be made by a key is replaced



with an 8-bit instruction from the microprocessor. The number of input instructions is limited only by the amount of memory in the microprocessor system. The calculator contains four register stacks with nine memory registers and can perform a variety of complex mathematical functions. Price of the unit is $189. Circle No. 116

A **single board computer** from Control Logic, Inc., the MM1-MSC, has four serial I/O ports which can communicate asynchronously at selectable baud rates of 110 to 9600 baud or synchronously at rates in excess of 50K baud. Processing capability is provided by a Zilog Z80 CPU with 1K byte of 2708 EPROM or 2K bytes of 2716 EPROM and 1280 bytes of RAM. A priority interrupt controller provides interrupt capability upon receipt of data from all four ports as well as three external interrupt states, the company says.

Compatible with Control Logic's MM1 microcomputer line, the unit can serve as a front-end communications processor for a general-purpose microcomputer system or as a stand-alone single board computer. Price is $950. Circle No. 121

A miniature **chain nose plier** has been added to the stock line of Hunter Tools, El Monte, CA. Designed for use by hobbyist or technician, the small plier, Model 20145, is 4½" long and 7/32" at the joint with an 11/32" head. Designed with radius edges and smooth gripping surfaces to protect delicate assemblies, the 20145 is made to reach into those tight spots that hobbyists often encounter. The 20145 has a coil spring which returns the plier to open position in repetitive use, thus reducing hand fatigue. Circle No. 115

Assembly Specialists, Acton, MA, has introduced a line of **thick film resistor chips** with leads. These chips are available in values ranging from 10 ohms to 25 megohms with specified tolerances of 1%, 2%, 5%, 10%, 20% and 25%. Chip size is 0.200 x 0.200 x 0.025 or 0.300 x 0.300 x 0.025, with lead spacings on 100, 0.125 or 0.150 inch centers. The chips also feature low noise (less than 5 UV/V), controlled TCR (less than 50 PPM if required), and leads pre-tinned for easy soldering onto PC boards. Circle No. 105

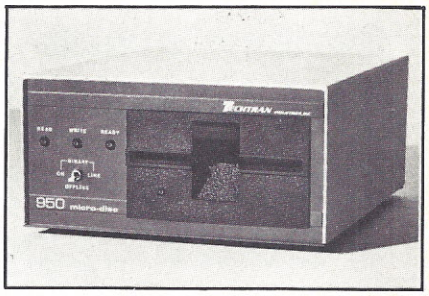
A Super-Mite (SM) **switching regulated power supply** is the newest product from LH Research of Irvine, CA. The Super-Mite has an input range of 92-130 VAC or 184-250 VAC, designed to protect against brown-outs. Hold-up time is 35 msec in case of AC power failure. A power-fail signal triggers 20 msec (one cycle at 50 Hz) after loss of AC power. Units can be directly paralleled without a master or special hookup. The device is available in four single-output voltages: 2v/225 amps, 5v/200 amps, 12v/84 amps and 15v at 67 amps. Circle No. 109

Micropolis Corp., of Newport Beach, CA, says that introduction of the new Model 1055 high-capacity **floppy disk drive** extends the company's marketing field beyond hobbyists and small business sytems. The 1055 is a high-performance, high-reliability product, claims a company spokesman, and it has storage capacities comparable to 8-inch disks at about half the price. The intelligent controller of the 1055 permits attachment to virtually any 8- or 16-bit micro/mini computer. Among the usage improvements claimed for the 1055 are status lights, file protection and measures to prevent improper insertion of a diskette. Industrial grade standards for testing, burn-in and inspections are used and the company offers full documentation at no extra charge. Circle No. 112

A new line of **multiple output power supplies** is announced by Acopian of Easton, PA. Included are dual and triple output models with current ratings to 6 amps and voltage outputs of 5, 9, 12 and 15 volts. All outputs are floating and may be connected in either polarity. Options include overvoltage protection and 210-250 VAC input. Prices vary from $120 to $195 and shipment is promised 3 days after receipt of order. Circle No. 119

An extra-length (450' of tape) **data cartridge** is now available from 3M Company's Data Products Mincom Division. The Scotch brand DC 300XL cartridge is designed for backup of disk data systems and for use in applications involving extensive logging. The new cartridge contains specifically developed tape and has an improved heat-stable hub. The basic price for the DC 300A is $20; the DC 300XL is $23. Circle No. 114

A low-cost **mini-diskette**, by Techtran of Rochester, NY, features more than 200K characters of storage. The company says the diskette, Model 950 Micro-Disc, is the only economical system with that much memory. The 950 uses a Shugart drive and incorporates state-of-the-art microprocessor technology. Data can be recorded in either file or batch modes with the 950 automatic-

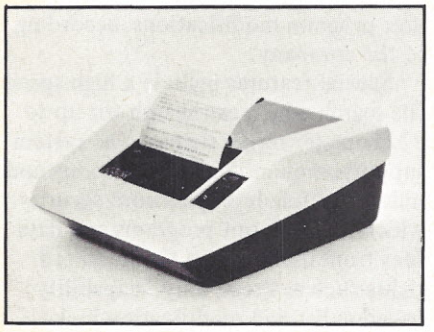


ally entering file names into the directory for total random access. Switch selectable data rates to 9600 baud supply online or offline operations. A binary mode is an additional standard feature providing for code transparent applications. Techtran's 950 is list priced at $1395. Circle No. 106

A new "K Series" Accutrack **cassette** has been introduced by the Kybe Corp., Waltham, MA. Features of the cassette's

construction include fiberglass reinforcement, premium grade tape, low-friction slipsheets, machined Delrin tape rollers, precise head-to-tape contact and a dual write-lockout system to guard against accidental erasure of data. Prices range from $4.30 to $6.95. Circle No. 113

A new, intelligent, electrosensitive **line printer,** Model EX-801 MicroPrinter, has been announced by Axiom of Glendale, CA. The compact desk-top printer operates at 160 characters per second and offers a choice of three character sizes. It is designed for CRT hardcopy, data logging, program listing and record keeping. The new printer is a complete, stand-alone unit and includes case, power supply, parallel ASCII and RS232C/20 mA interface, character generator, low paper detect-



or, bell, built-in self tester and paper roll holder. The price of the printer is $655. Circle No. 108

Aresco's resident **assembler/text editor** allows entering, storing, editing, and assembling programs for 650X-based processing systems. Although designed primarily for use with the KIM system, the editor/assembler runs on any 650X system such at TIM, Apple, OSI and Baby!, and comes with a complete source listing, Aresco says.

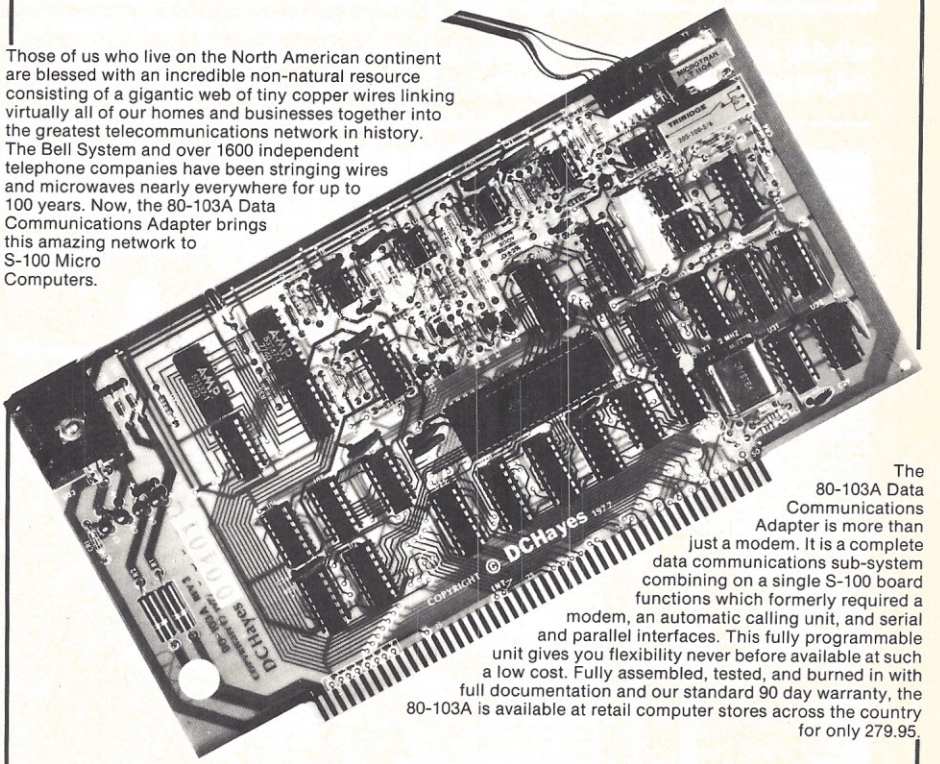
The text editor, for creating, editing, and saving line-numbered text files stored in RAM, supports such functions as entering new text, deleting text, finding a designated string in text, resequencing line numbers, listing a specified block of text, loading text from paper tape or audio cassette, returning to the monitor, dumping the text file to paper tape or audio cassette, clearing the text area, and transferring control to the assembler.

Another feature is line-number orientation allowing users to extend the editor to fit their needs, Aresco says. Text files are completely relocatable in memory, and multiple text files may be in memory simultaneously. Text file length is limited only by available memory.

The resident, single-pass assembler accepts the entire 650X instruction set, using standard MOS Technology notation. Source code may be paper tape or memory resident, and object code is always written to memory. Features include user-specified input and output routines which default to the TTY. The single pass provides source listing, object code and error

modem / 'mo • dəm / [**mod**ulator + **dem**odulator] *n - s* : a device for transmission of digital information via an analog channel such as a telephone circuit.

Those of us who live on the North American continent are blessed with an incredible non-natural resource consisting of a gigantic web of tiny copper wires linking virtually all of our homes and businesses together into the greatest telecommunications network in history. The Bell System and over 1600 independent telephone companies have been stringing wires and microwaves nearly everywhere for up to 100 years. Now, the 80-103A Data Communications Adapter brings this amazing network to S-100 Micro Computers.



The 80-103A Data Communications Adapter is more than just a modem. It is a complete data communications sub-system combining on a single S-100 board functions which formerly required a modem, an automatic calling unit, and serial and parallel interfaces. This fully programmable unit gives you flexibility never before available at such a low cost. Fully assembled, tested, and burned in with full documentation and our standard 90 day warranty, the 80-103A is available at retail computer stores across the country for only 279.95.

D.C. Hayes Associates Inc.

P.O. BOX 9884 • ATLANTA, GA. 30319 • (404) 231-0574

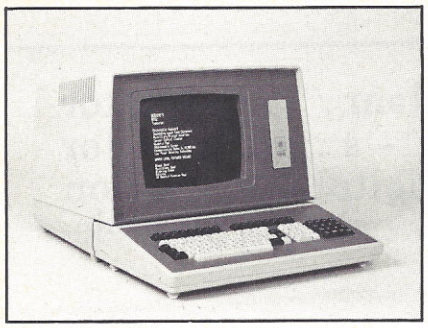
Distributed in Canada by TRINTRONICS LIMITED, Toronto

CIRCLE 17

messages, with user-defined symbol table and source location areas.

The complete system occupies 6K of memory and object code is available on KIM cassette or paper tape (KIM/TIM format) from ARESCO for $70. Circle No. 128

A new **video display computer terminal**, model B152, has been introduced by Beehive of Salt Lake City. Features of the display include de-



tachable keyboard with 11-key numeric pad, upper and lower case descender characters, single cursor movement keys, video erase functions and an auxiliary printer interface. The company also has an upper level configuration of their new unit which, in addition to lower level features, adds formatting, block transfer, editing ability and 16 special function keys which can call up specific formats from the host computer. Circle No. 118

The "Silverstat Soldpullt", by Edsyn of Van Nuys, CA, is a new **desoldering tool** which protects sensitive FET and MOSFET semiconductor devices from catastrophic failure due to static electricity. The tool is a hand-held, spring-loaded vacuum device. It has a fully enclosed loading shaft, high-low vacuum adjustment and bayonet-type disassembly. The conductive plastic tip and barrel housing allow any built-up static charge to drain off harmlessly through the hand to the ground. There are no conductive straps attached to the tool which might hinder hand movement. Still necessary, though, are the usual precautions of having conductive work mats and grounded wrist or body straps. Circle No. 117

Ohio Scientific's new **operating system**, OS-65U, is designed for business applications programmers and small business system users and is based on 9½ digit precision BASIC for 6502 by Microsoft. All operating system extensions are incorporated in BASIC so all operating system commands can be executed in the immediate or stored program mode.

The system supports multiple terminals, multiple line printers and other I/Os such as modems and internal video display systems. The operating system supports up to four floppy disk drives and up to four 74 megabyte hard disk drives. The system's continuous memory file system will support future bubble and CCD memories without any user program modifications, according to the company.

Special features include a high speed file search which can search for up to 32 character target strings. The system supports sequential, random access and index multiple level password security which can lock out programs and data files from users or give them limited rights such as "read only" capability; program list and modification lockouts so that applications programs can be protected from copying; comprehensive error detection and automatic error recovery. OS-65U runs on any Ohio Scientific floppy or hard disk based computer with 32K of RAM memory and costs $199 per computer system license. Circle No. 133

Hewlett-Packard now has a tape cartridge mass memory unit that performs data logging from a data source without the need for a controller, and transports data between different H-P desktop computers. The HP 9875 **Cartridge Tape Unit** comes in either single or double tape drive configurations, with each tape containing up to 225K bytes. Both models share data interchange and acquisition capabilities. A built-in microprocessor offers a 23-command set for formatting flexibility.

Through an IEEE Standard 488-1975 bus, the HP 9875 may be interfaced to any Hewlett-Packard Series 9800 desktop computer. The unit can store data from any computer in the series and read that data into any other.

ALDELCO ELECTRONICS COMPANY

VOLTAGE REGULATORS
TO220 Package
Positive $1.00 Negative $1.25

7805	7905
7806	7908
7808	7912
7812	7915
7815	7918

RECTIFIERS

2 Amp 50 Volt	20 for	$1.00
2 Amp 200 Volt	18 for	1.00
2 Amp 400 Volt	16 for	1.00
2 Amp 600 Volt	14 for	1.00
2 Amp 800 Volt	12 for	1.00
2 Amp 1000 Volt	10 for	1.00
2 Amp 1500 Volt	5 for	1.00
10 Amp Stud 50 Volt		.45
10 Amp Stud 600 Volt		1.15
40 Amp Stud 50 Volt		1.20
40 Amp Stud 750 Volt		1.95

BRIDGE RECTIFIERS

2 Amp 50 Volt TO5	.35
2 Amp 200 Volt TO5	.50
2 Amp 600 Volt TO5	1.25
3 Amp 50 Volt	.50
3 Amp 400 Volt	1.10
25 Amp 200 Volt	1.50
25 Amp 600 Volt	2.50
25 Amp 1000 Volt	5.50

FETS

40673	1.55
MPF102	.55
2N3819	.35
2N5457	.50
2N5458	.50
2N5459	.55
2N5485	.50
2N5486	.72

DARLINGTONS

MPSA 13(SPS5700)	.80
MPSA 14	.90
2N5306	.50

SCRs

C106A 4 Amp 100 Volt	.55
C106B 4 Amp 200 Volt	.65
C122B 8 Amp 200 Volt	.85

MISC. ICs

LM304H	1.00
LM307N	.45
LM307V	.90
LM308H	1.00
LM309H	1.10
LM309K	1.10
LM311	.90
LM312H	.65
LM312CJ	.65
LM380	1.45
LM710	.60
LM711	.40
LM723N	.55
LM723H	.55
LM741CJ	.25
CA3028	1.50
CA3041 (LM3900)	.55

DIODES

1N34	10 for 1.00
1N60	10 for 1.00
1N64	10 for 1.00
1N82A	.40
1N270	.30

SPEAKERS

2" 8 Ohm Round	.65
2-1/4" 8 Ohm Round	.75
2-1/2" 8 Ohm Round	1.00
2-1/2" 100 Ohm Round	1.25

add 10¢ per Speaker shipping

ALDELCO KITS
Power Supply Kit of Parts with with Instructions

5 Volt 6 Amp	$17.50
+15 & -15 Volts	16.95

Variable P.S. Kits

5 to 15 Volts 600 MA	6.95
12 to 20 Volts 600 MA	6.95

Includes PC Board & Instructions

Digital Clock
12 Hour Alarm. 0.6 LED Display Elapsed Timer. Snooze Feature with 110 Volt Power Supply 19.95

12/24 Hour Clock Kit six 0.5 Display LEDs 18.95

WOOD GRAIN CABINET
$4.95



Crystal Time Base Kit	4.95
Blinkey Flasher Kit	2.95

CLOCK CHIPS

5313	3.49
5314	3.99
5316	3.99
5375	3.99
CT7001	6.95

TIMER SPECIAL
555's
3 for $1.00

CAPACITOR SPECIALS

.1	.033	470pf
.01	20pf	510pf
.001	100pf	800pf

25 for one dollar

.01 Disc Cap. 30VDC
100 for $3.50
500 for $15.50

LEDS
Monsanto MV5053 Jumbo Red LED and Holder .25 each
LED Holders .10 each
Jumbo Red LEDS 6 for $1.00
Jumbo Orange, Green or Yellow LEDS 5 for $1.00

DISPLAY LEDS

FND 70	.59
FND 500	1.25
FND 303 or 507	1.35

PROFESSIONAL KEY BOARD KIT
Model 753 ASCII Keyboard features 53 keys, popular ASR-33 format, Rugged G-10 PCB. Tri-mode MOS encoding, two key rollover, MOS/DTL/TTL Compatible outputs, Upper case lockout, Data and Strobe inversion option, Low contact bounce, selectable parity & More.

Model 753K (Kit)	$59.95
Model 753 (Assembled)	71.25

ORDERS UNDER $10.00 ADD $1.00. ADD 5% SHIPPING. OUT OF USA, CANADA & MEXICO ADD 15% SHIPPING AND CERTIFIED CHECK OR MONEY ORDER IN USA FUNDS.

ALDELCO 2281 BABYLON TURNPIKE, MERRICK NY 11566
516-378-4555

CIRCLE 26

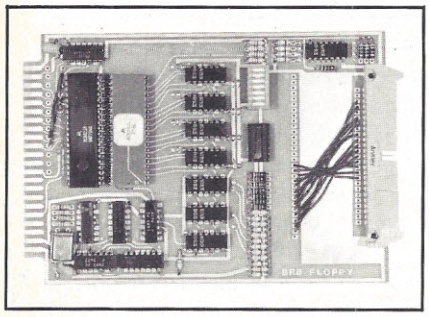
Old data files, therefore, can be used on new computers without manually re-entering the data, H-P says.

A listen-only mode lets HP 9875 perform certain data acquisition operations independent of an external controller. In the programmable listen-only mode, the unit can read a tape command and execute it. In the talk-only mode, the tape unit can operate certain peripheral devices such as printers.

Like a disk, the HP 9875 partitions its tapes into files and records, with two physical tape tracks treated as a single logical track. Data can be organized into either serial access or random access formats in record sizes from 2 to 256 bytes. The HP 9875 also comes with a programmable input/output delay and can respond to both serial and parallel polls.

Price is $2600 with one tape drive and $3100 with two tape drives. Optional H-P desktop computer interfacing is available. Circle No. 136

Wintek Corp. of Lafayette, IN, has incorporated the Motorola MCM 6843 floppy disk controller IC into a low-cost, versatile **floppy disk controller**, the BRB Floppy. The 4½" x 6½" module interfaces to any full size or mini floppy disk drive. The module supports both hard and soft sectoring,



IBM 3740 or user programmable read/write format, automatic CRC generation/checking, and programmable step and settling times. $199.00 unit price. Circle No. 107

Small-computer programs from one language can communicate with data from another language through Processor Technology's **Disk Operating System** (PTDOS). Extended BASIC, FORTRAN, FOCAL and PILOT are among the high level languages able to communicate with each other using this standard data format.

For example, a program running in FORTRAN can access data created in BASIC and then edit other data written in FOCAL. PTDOS permits raw data created under its own text editor or assembler to be accessed by these high-level languages, simplifying the programming of complex data manipulation applications such as word processing, PT says.

PTDOS runs on Sol systems which include the Sol-20 terminal computer with build-in keyboard and Helios II disk memory system. Integrated systems including PTDOS and Helios II start at $5995. Circle No. 135

STAND ALONE **VIDEO TERMINAL**

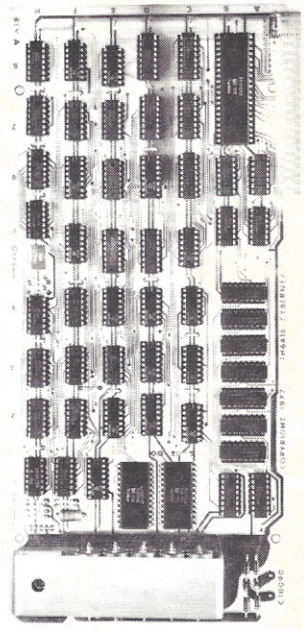
Now, a completely self-contained video terminal card for less than $150.00. Requires only an ASCII Keyboard and TV set to become a complete interactive terminal for connection to your computers serial IO port. Two units available, common features are: single 5V supply, crystal controlled sync and baud rates (to 9600 baud), computer and keyboard operated cursor control, parity error and control, power on initialization, forward spaces, line feed, rev. line feeds, home, return cursor, and clear to end of line. Power requirements are 5V at 900ma, output std. IV p-p video and serial TTL level data.

Features:	TH3216	TH6416
Display	32 characters by 16 lines 2 pages	64 characters by 16 lines scrolling
Characters	Upper case ASCII	Upper/lower case optional
Baud Rates	300-9600	110-9600
Controls	Read to/from memory	Scroll up or down
Price (kit)	$149.95	$189.95

Above prices include all IC sockets

OPTIONS:

Power supply (mounts on board) $14.95
Video/RF Modulator, VD-1 6.95
Lower case option (TH6416 only) 10.00
Assembled, tested units, add 60.00



CYBERNEX

"TH 6416 shown above"

Frequency Counter $79.95 KIT



You've requested it, and now it's here! The CT-50 Frequency Counter Kit has more features than counters selling for twice the price. Measuring frequency is now as easy as pushing a button, the CT-50 will automatically place the decimal point in all modes, giving you quick, reliable readings. Want to use the CT-50 mobile? No problem, it runs equally as well on 12 VDC as it does on 110 VAC. Want super accuracy? The CT-50 uses the popular TV color burst freq. of 3.579545 MHz for time base. Tap off a color TV with our adapter and get ultra accuracy — .001 ppm! The CT-50 offers professional quality at the unheard of price of $79.95. Order yours today!

SPECIFICATIONS

Sensitivity: less than 25MV
Frequency range: 5Hz to 60MHz, typically 65MHz
Gate time: 1 second, 1/10 second, with automatic decimal point positioning on both direct and prescale
Display: 8 digit red LED .4" height
Accuracy: 2 ppm, .001 ppm with TV time base!
Input: BNC, 1 meg ohm direct, 50 ohm with prescale option
Power: 110 VAC 5 watts or 12 VDC .4 Amp
Size: Approx. 6" x 4" x 2", high quality aluminum case

PRICES

CT-50, 60MHz Counter Kit $79.95
CT-50WT, 60 MHz counter, wired and tested $159.95
CT-600, 600 MHz prescaler option for CT-50, add . . $29.95

MINI-KITS

FM WIRELESS MIKE KIT
Transmit up to 300' to any FM radio. Sensitive mike input requires dynamic, crystal or ceramic mike. Runs on 3 to 9 volts.
FM-1 $2.95

TONE DECODER KIT
A complete tone decoder on a single PC Board. Features: 400 to 5000 Hz adjustable frequency range, voltage regulation. 567 IC. Useful for touch-tone decoding, tone burst detection, FSK demod. signaling, and many other uses. Use 7 for 12 button touchtone decoding. Runs on 5 to 12 volts.
Complete Kit, TD-1 $4.95

LED BLINKY KIT
A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons or warning type panel lights.
Complete Kit, BL-1 $2.95

SUPER-SNOOP AMPLIFIER
A super-sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as a general purpose test amplifier. Full 2 watts of output, runs on 6 to 12 volts, uses any type of mike. Requires 8-45 ohm speaker.
Complete Kit, BN-9 $4.95

MUSIC LIGHTS KIT
See music come alive! 3 different lights flicker with music or voice. One light for lows, one for the mid-range and one for the highs. Each channel individually adjustable, and drives up to 300 watts. Great for parties, band music, nite clubs and more.
Complete Kit, ML-1 $7.95

SIREN KIT
Produces upward and downward wail characteristic of police siren. 200mw audio output, runs on 3-9 volts, uses 8-45 ohm speaker.
Complete Kit. SM-3 $2.95

POWER SUPPLY KIT
Complete triple regulated power supply provides variable ±15 volts at 200ma and +5 volts at 1 amp. 50mv load regulation, good filtering and small size. Kit less transformers. Requires 6-8V at 1 amp and 18 to 30VCT.
Complete Kit, PS-3LT $6.95

VIDEO TO RF MODULATOR
Convert any TV set to a video monitor. Super stable circuit is glitch-free, tunable over channels 4-6. Runs on 5-15V. Recommended by many computer manufacturers. Std. video input. Complete kit, VD-1 $6.95

741 OP-AMP MINI DIP 10/$2.00

LINEAR		REGS		TRANSISTORS	
555	.50	309K	.99	NPN 2N3904 type	10/$1.00
556	.75	340K-12	.99	PNP 2N3906 type	10/$1.00
566	1.49	7805	.99	NPN Power Tab 40W	3/$1.00
567	1.49	7812	.99	PNP Power Tab 40W	3/$1.00
324	1.49	7815	.99	FET MPF-102 type	3/$2.00
1458	.49	78MG	1.50	UJT 2N2646 type	3/$2.00
380	1.49	723	.49	2N3055 NPN Power	.75

RS232/TTL TTL/RS232 Converter kit Complete kit $7.95

IC SOCKETS

8 pin	low profile	5/$1.00
14 pin	low profile	5/$1.00
16 pin	low profile	5/$1.00
40 pin	low profile	2/$1.00
14 pin	wire wrap	3/$1.00

ramsey electronics

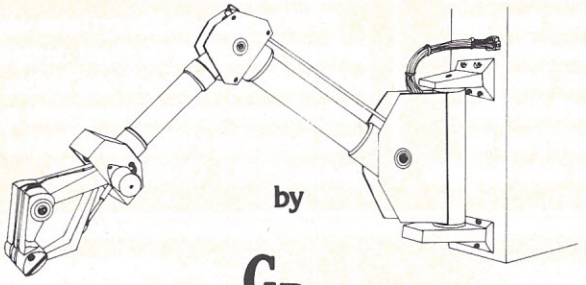
BOX 4072P ROCHESTER, NY 14610 (716) 271-6487

Phone orders welcome Minimum order $8.00

Satisfaction guaranteed or money refunded. Orders under $10 add 75c. COD add $1.00. NY add 7% sales tax.

CIRCLE 18

ROBOTICS



by

GRI

MODULAR ROBOTS for Industrial and Personal Application

Send for complete brochure to:
GALLAHER RESEARCH, INC.
P.O. Box 10767
Salem Station
Winston-Salem, N.C. 27108

CIRCLE 19

Bits ytes ooks argains



We stock various books and magazines of interest to the engineer and computer hobbyist. We also have available a large selection of components and used electronic test equipment.

IMSAI
Cromemco
SWTPC
Lear-Siegler
Vector
Solid State Music
And Others

MARKETLINE SYSTEMS, Inc.
2337 Philmont Ave.
Huntingdon Valley, Pa. 19006
In PA: 215/947-6670
800/523-5355
Dealer Inquiries Invited

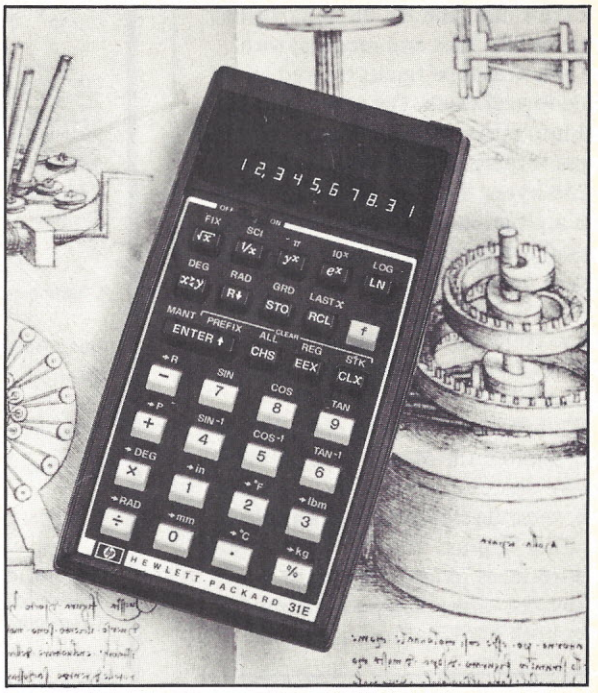
CIRCLE 20

WHAT'S COMING UP

Five hand-held scientific and financial **calculators** from Hewlett-Packard feature a new display size and error messages. Series E consists of the HP-31E, HP-32E and HP-33E scientific models and the HP-37E and HP-38E business models.

LED displays, the largest ever used on Hewlett-Packard hand-held calculators, allow easier and more accurate reading, H-P says. Each calculator automatically inserts commas in displayed numbers, and a battery indicator light on the display warns when batteries need recharging.

Another feature of the calculators is a diagnostic



error code system. When the operator makes a mistake, the calculator displays one of nine code numbers, each representing an operating or programming mistake.

Priced at $75, the HP-37E business management calculator can develop amortization schedules, compute the retail functions of percent, percent change, percent of total and calculate list price given item cost and expected margin. The HP-37E can also solve five-variable financial problems (that is, handle present value, payment and future value functions simultaneously).

At $120, the programmable HP-38E has all the functions of the HP-37E, plus discounted cash flow analysis and internal rate of return for as many as 1,980 grouped cash flows, simple interest, calendar functions, weighted average and rounding keys and 30 storage registers.

The $60 HP-31E features arithmetic, logarithmic and trigonometric functions, fixed and scientific display modes and rectangular/polar, degree/radian, inch/millimeter, Fahrenheit/Centigrade and pound/kilogram conversion keys.

The HP-32E, at $80, incorporates all of the features of the HP-31E with an engineering display mode and

hyperbolic functions and their inverses. It also features a U.S. gallons/liters key, a decimal degree and hour/hours, minutes, seconds key and a collection of statistical functions including linear regression, correlation coefficient, x and y estimates, normal and inverse normal distribution and factorial.

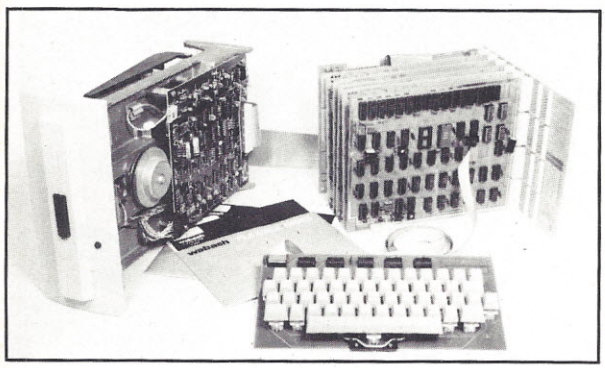
The HP-33E $100 calculator has all of the features of the HP-32E, except hyperbolics, metrics and some statistical functions.

Circle No. 131

TEXT, a text (or word) processor from Electronic Product Associates, allows free-format entry of text. This feature permits the user to type the document text with one word per line, with very long lines, or with a combination of both. The software then adjusts the text to the desired output format. According to EPA, this feature simplifies document updating since TEXT automatically formats the new document by entering modifications where desired.

Other features include left and right justification, automatic word hyphenation, page headings, page footings (including page numbers), indenting, centering, single, double or triple spacing of lines, footnotes and bibliography references. TEXT runs on the EPA Micro-68b computer with 16K RAM, one floppy disk, one CRT and a printer. Circle No. 141

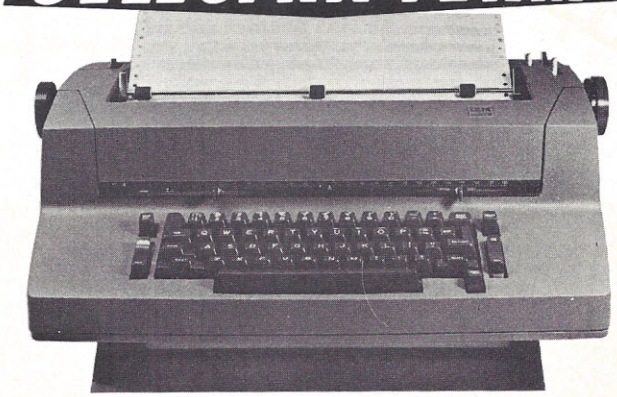
Ohio Scientific now offers two fully assembled but unbundled **floppy disk based computer systems** as part of its Challenger II product line. Both feature a 6502A microprocessor, 16K of dynamic RAM memory and an 8" floppy disk drive and interface. Both systems have OSI's 8-slot backplane for system expansion, and both come with software and manuals but without cases or power supplies.



Model C2-8SK includes a standard RS-232 serial I/O port for use with external computer terminal. Model C2-8VS comes with a 32 x 64 character video display board and a keyboard; only a video monitor is required to complete the system. The C2-8SK with serial interface retails for $1590.00 and the C2-8VS with video interface retails for $2090.00.
Circle No. 134

Sonar Scan model 3300 is a microcomputer **crime deterrent system** from Technology Systems Corporation. This solid-state system uses a Fairchild microprocessor and can address 65K bytes of memory.

SELECTRA-TERM™



The Best SELECTRIC II* Printer Going for ANY Computer!

SELECTRA-TERM is a brand new IBM Selectric II* typewriter which has been fully converted for direct connection to your computer. A special typing element gives you full ASCII and upper/lower case alphanumerics. You also have backspace, tab, index and bell—all under computer control.

SELECTRA-TERM can also be used as a standard typewriter. It has been approved for computer use and comes with the IBM warranty. You may also obtain the yearly service agreement for the typewriter portion. MCD provides their own factory warranty on the electronics conversion.

Complete electronics package, cable sets and documentation are supplied. Price is $1750 with many options. Ask your dealer for details or contact:

MCD
micro computer devices, inc.
960 E Orangethorpe, Bldg. F
Anaheim, California 92801
Telephone (714) 992-2270

*Reg. trademark of IBM Corp.

CIRCLE 21

IT'S A GREAT BIG COMPUTER WORLD
But You Only Need

THE COMPUTER CORNER

- SOL — A New Dawn Is Here!
- IMSAI 8080
- POLY — 88
- TDL Z-80
- Memories & I/O Boards
- Computer Book Service
- Magnetic Tapes & Disks
- Full Line of Magazines
- Brain Games & Puzzles
- Workshops & Club Information

Visit THE COMPUTER CORNER for all your computer needs. Stop in and browse — you'll like our personal service.

THE COMPUTER CORNER
White Plains Mall — Upper Level
200 Hamilton Avenue
White Plains, New York 10601
Tel: (914) WHY - DATA

Ample Parking
10-6 Daily & Saturday
10-9 Thursday

CIRCLE 22

TWO BYTES ARE BETTER THAN ONE

COMPARE
16-BIT COMPUTERS

THE
TECHNICO
SUPER STARTER
SYSTEM
AND
SUPER SYSTEM 16

V.S.

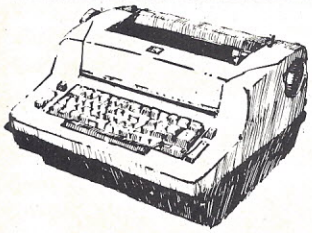
THE HEATH H-11

SAVE OVER $1000
SEND FOR FREE BROCHURE

TECHNICO 1-800-638-2893
9130 RED BRANCH RD. COLUMBIA, MD 21045
DEALER INQUIRIES INVITED

CIRCLE 23

SUPER SALE



$199.95
AS IS

$249.95
WORKING &
CLEANED

IBM® Selectric-Based
I/O Writers
Excellent Hobby Printers

Series 72/731
Heavy Duty
8½" Platten
All Solenoids
Original Documentation
While Supply Lasts

These terminals are from a large airline reservation system. They are heavy duty and were under continuous maintenance. The units have been in storage. We make every effort to ensure that all essential parts are included. Most work when plugged in. No warranties are given or implied.

Conversion Kits.
1. Conversion instructions, P C board for printer only using software method $59.95
2. I/O kit, instructions and all components for parallel or RS232 interface $249.95
3. Completely converted unit and assembled interface $999.95

Check, Money Order, Cash. Personal checks require 3 weeks to clear. No COD's. Units shipped UPS or PP collect. Prices Net FOB Tulsa

SUPER SURPLUS SALES
P.O. BOX 45944
TULSA, OK 74145
1-918-622-1058

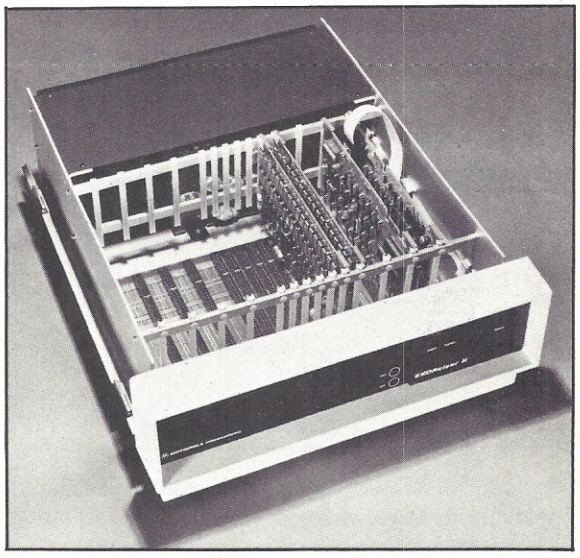
CIRCLE 29

Sonar Scan is capable of intelligent two-way communication with intrusion, fire, smoke and other auxiliary sensors over three independent channels via existing building A.C. wall outlets and/or parallel hardwired lines.

An LED digital display provides a visual indication of the type of alarm as well as its location in the building. Model 3300 is tamper-proof once armed with its two-digit programmable arming code, the company says. (The unit utilizes a three-digit programmable disarming code.) In addition, it is self-testing and can even generate its own sounds to test that all circuits are operative. Suggested list price is $1295. Circle No. 132

EXORcisor II, an extended version of the EXORcisor development system, aids design and development of microcomputer systems based on Motorola's M68BXX series of 2 MHz chips, according to Motorola. EXORciser II also supports designs based on the M68AXX (1.5 MHz) and M6800 (1.0 MHz) series. Optional modules can configure EXORciser II for development of systems based on other microprocessor families offered by Motorola, including the MC3870 Microcontroller, the MC141000 Microcomputer and the MC2900 (TTL) and MC10800 (MECL) 4-bit slices.

Motorola says EXORciser II features a dual memory map mode which lowers development time and cost by allowing full use of the microprocessor addressing map, regardless of the addressing requirements of the EXORciser II and its system peripherals.



Optional modules are provided with a jumpering arrangement for assigning memory and peripherals to either map in the dual map mode, or to any page in extended memory systems.

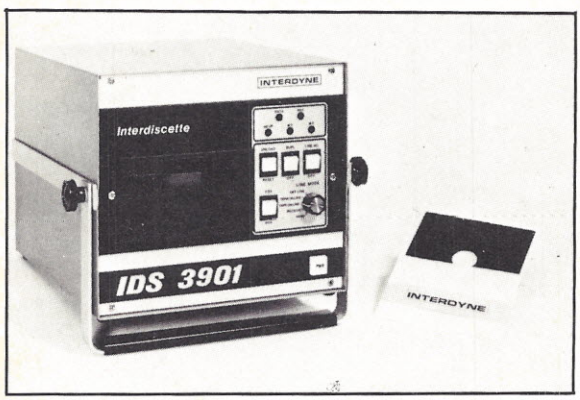
The basic EXORciser II consists of the MEX6800-2 MPU II and MEX68DB2 Debug II modules, power supply and a 14-slot chassis with cover to accommodate the printed circuit board modules with which the user emulates his microcomputer system hardware. A motherboard provides power and signal con-

nections to the microprocessor control, data and address buses and an RS-232C port allows communication with peripherals. Also supplied with the basic unit are 32K of memory from either the MEX6816-22S 16K Static RAM or the MEX6816-22D 16K Dynamic RAM (user's choice), and Macro Assembler/Linking Loader and Text Editor programs on paper tape, cassette or diskette. The MPU II module contains the MC68B00 microprocessing unit as well as an MC6840 Timer and an MC6828 Priority Interrupt Controller.

The Debug II module allows the user to communicate with his system, load programs, monitor the execution of this program in real time and to isolate and analyze hardware and software problems The module supplies eight selectable baud rates ranging from 110 to 9600 bps.

Prices for EXORcisor II start at $7250. Circle No. 142

A fast-access intelligent **buffered data terminal,** Model IDS 3901 from Interdyne Company, uses a 5¼" diskette drive and is RS-232C compatible. Average access time is 0.6 seconds. It has a fully



editable data buffer holding up to 128 characters, a block rewrite capability and allows insertion of blocks or paragraphs into previously written text. Including an automatic high-speed block search and verify as well as character pattern search, the IDS 3901 is controlled by 30 ASCII commands and outputs 13 plain English messages.

Other featues include storage of 143K bytes formatted per diskette, switch-selectable asynchronous baud rates from 110 to 19.2K ASCII text as well as transparent binary modes and auto error check and retry. Price in single quantity is $2,050. Circle No. 140

Automated Logic Corporation offers five microprocessor **cross assemblers** for Digital Equipment Corporation's PDP-11 minicomputers and LSI-II microprocessors. The MicroSeries cross assemblers can be used for Intel 4040, 8080, 8085, 8748, 8048, 8041, 8035 and 8021 microprocessors. The MicroSeries runs in 12K of memory and enables programs to be developed using the PDP-11 with the RT-11 operating system. A companion program allows output from the cross assembler to be shipped directly to burn the PROMs. Price is $250. Circle No. 130

TERMINALS FROM TRANSNET

OUTRIGHT PURCHASE OR FULL OWNERSHIP UNDER OUR 24 MONTH 100% EQUITY RENTAL PLAN

	PURCHASE PRICE	*PER MO. 24 MOS.
DECwriter II	$1,495	$ 75
DECwriter III	2,895	145
DECprinter I	2,495	125
VT52 DECscope	1,695	85
VT55 DECgraphic CRT	2,695	135
TI 745 Portable	1,875	94
TI 765 Bubble Memory	2,995	152
TI 810 RO Printer	1,895	97
ADM 3A CRT	875	45
ADDS Regent 100	1,325	67
Data Prod. 2230	7,900	395
QUME Ltr. Qual. KSR	3,195	163
QUME Ltr. Qual. RO	2,795	143
FlexiFile 21, Fl. Disk	1,995	102

*FULL OWNERSHIP AFTER 24 MONTHS

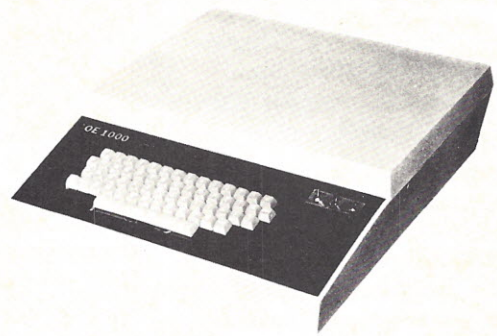
12 MONTH FULL OWNERSHIP, 36 MONTH LEASE AND RENTAL PLANS AVAILABLE ON ABOVE AND OTHER EQUIPMENT

MOST EQUIPMENT AND OPTIONS IN STOCK FOR IMMEDIATE SHIPMENT

TRANSNET CORPORATION
2005 Route 22, Union, N.J. 07083
201-688-7800

CIRCLE 24

NOW A SOLUTION TO YOUR I/O HEADACHE #33



The OE 1000 Terminal is a low cost stand alone video terminal that operates quietly and maintenance free. It will allow you to display on a monitor or modified T.V. 16 lines of 64 characters. The characters can be any of the 96 ASCII alphanumerics, and any of the 32 special characters. In addition to upper-lower case capability it has a scroll up feature and full X-Y cursor control. All that is required from your microcomputer is 300 baud, RS 232 or 20 mA current loop, serial data. And if that is not enough the price is only $275.00 in kit or $350.00 assembled, plus $3.00 shipping and handling. To order phone or write:

OTTO ELECTRONICS
P.O. Box 3066
Princeton, N.J. 08540
609/448-9165

MC, BAC, COD accepted N.J. residents add 5% sales tax.
Dealer Inquiries invited.

CIRCLE 25

CLASSIFIEDS

Z-80 Disassembler

Zilog Mnemonics

North Star of CP/M Disc Systems, Others on special request $30.00/ $35.00 spec.

Microlithics, Inc.
Bits, Bytes & Micros
2918 N. Mac Arthur Blvd.
Oklahoma City, OK 73127
(405) 947-5646

SIXTY BASIC Programs for Payroll, Investment, Engineering, Production, Inventory, Economics, Business, Household and Biorhythm Applications. Debugged and Tested. $15.00 Postpaid. **DIDACTIX** 45 Henley Road, Buffalo, NY 14216

Personal Computing Classified Rates

Individual: $1 per word; address set free; first two words set in all capital letters for free. If you want **bold** type, add $1 for each word set bold. Add $5 if you want replies sent to us and forwarded to you.

Company: 1X: $60/inch; 3X: $55/inch; 6X: $50/inch. Display ads accepted only if camera-ready materials submitted. Agency commission paid on camera-ready ads and after the first insertion of a publisher-set ad if subsequent insertions run without changes. Publisher sets ads in format and attempts to fit copy into space requested.

Advertisement accepted, however, with understanding that space may be larger than requested. Minimum billing size one inch; ads billed in half-inch increments thereafter. Frequency rate applies to publisher-set ads only if they run without changes in subsequent issues.

To place an ad, send copy to Classified Ad Dept.
Personal Computing
1050 Commonwealth Ave.
Boston, MA 02215

ADVERTISERS' INDEX

Aldelco 106

Byte Shop 2
Byte Shop #32 96

Caldwell Computer 17
Computer Corner 108
Computer Enterprises 77
Computer Factory 3
Computerland 112, C-3
Crea/Comp 8

D.C. Hayes 105

GRI 109

Industrial & Scientific Conf. Mgmt. . 75

Marketline Systems 109
Micro Computer Devices 108
Micro Force 103
Minicomputer News 78

NCC 86
Netronics 2

Otto Electronics 111

Personal Computing 18
Polymorphic Systems 53

Ramsey Electronics 107

Seals 5
Smoke Signal 7
Space Byte 1
Soroc Technology C-4
Super Surplus Sales 110
Sybex 98

Technico 110
Telpar 74
Transnet 111

V.S.I. 97

SALES OFFICES

Northeast: George Palken, 1050 Commonwealth Ave., Boston, MA 02215; (617) 232-5470 • **Mid-Atlantic**: Arthur Daks, 104 So. Central Ave., Valley Stream, NY 11580; (516) 872-9550 • **Midwest**: Hank Bean, 2633 Hillside Lane, Evanston, IL 60201; (312) 475-7173 • **Los Angeles**: Yuri Spiro & Carol Stagg, 924 Westwood Blvd., Suite 610, Los Angeles, CA 90024; (213) 478-3017 • **San Francisco**: Ralph Petersen, 1180 Oak Creek Dr., Palo Alto, CA 94304; (415) 328-4392 • **Japan**: Hiro H. Irie, International Business Corp., 11-8, Narita-Higashi 1-chome, Suginami-KU, Tokyo 166; Phone: (03) 311-1746 • Exposition Service Sales Office: Louise Garcia, (505) 898-4562.

45 GREAT LOCATIONS

ComputerLand

NOW OPEN:

ALABAMA	
Huntsville	(205) 539-120
CALIFORNIA	
Dublin	(415) 828-809
El Cerrito	(415) 233-501
Hayward	(415) 538-808
Los Altos	(415) 941-815
Los Angeles	(213) 776-808
Mission Viejo	(714) 770-013
San Bernardino	(714) 886-683
San Diego	(714) 560-991
San Francisco	(415) 546-159
San Jose	(408) 253-808
San Mateo	(415) 572-808
Santa Rosa	Call Directory Assistanc
Thousand Oaks	(805) 495-355
Lawndale	(213) 371-714
Tustin	(714) 544-054
Walnut Creek	(415) 935-650
COLORADO	
Denver	(303) 759-468
CONNECTICUT	
Fairfield	(203) 374-222
DELAWARE	
Newark	(302) 738-965
GEORGIA	
Atlanta	(404) 953-040
ILLINOIS	
Arlington Heights	(312) 255-648
Niles	(312) 967-171
Oak Lawn	(312) 422-808
KENTUCKY	
Louisville	(502) 425-830
MARYLAND	
Rockville	(301) 948-767
MICHIGAN	
Grand Rapids	(616) 942-293
Detroit	(313) 356-811
MINNESOTA	
Bloomington	Call Directory Assistanc
NEW HAMPSHIRE	
Nashua	(603) 889-523
NEW JERSEY	
Cherry Hill	(609) 795-590
Fair Lawn	Call Directory Assistanc
Morristown	(201) 539-407
NEW YORK	
Buffalo	(716) 836-651
Ithaca	(607) 277-488
OHIO	
Cleveland	(216) 461-120
OREGON	
Portland	(503) 620-617
TEXAS	
Austin	(512) 452-570
Houston	(713) 977-090
WASHINGTON	
Bellevue	(206) 746-207
Federal Way	(206) 838-936
Tacoma	(206) 581-038
WASHINGTON, D.C.	Call Directory Assistanc
WISCONSIN	
Madison	Call Directory Assistanc
INTERNATIONAL	
Sydney, NSW Australia	29-37

Rated G

The Best Game in Town.

Welcome to ComputerLand. An incredible adventure into the world of personal computers. A one-of-a-kind shopping experience.



Each ComputerLand store presents everything you ever wanted to know about computers. And then some.

Take our Game Room, for starters. You'll find excitement for the whole family in our endless variety of challenging computer games. You can battle the Klingons in an out-of-this-world game of Star Trek. Create an electronic work of art with a computer controlled TV. Test your skill in a game of computerized hangman.

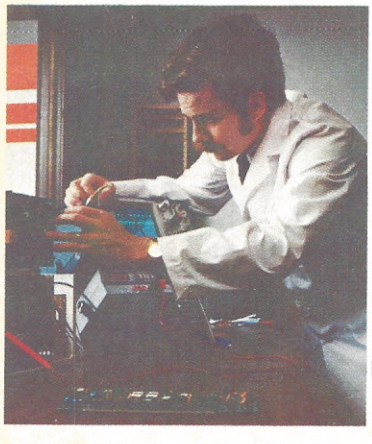
You can even plot your biorhythm.

But we're more than just fun and games. Each ComputerLand store offers a knowledgeable and personable staff of professionals



to serve you.

Plus the greatest available selection of micro components. Whether it's a data processing system for your business or a computer controlled sprinkler system for your home, you'll find whatever you need at ComputerLand.



Read on.

Genuine Service.

We want to supply you with the one system that's right. Rather than a complete system that isn't. Or a limited system that is.

That's why, at ComputerLand, you deal with real professionals who are also real people. People who speak your language . . . in addition to BASIC, COBOL or FORTRAN.

People, in short, who can offer both the novice and the old hand the same expert guidance in selecting the optimum system he or she needs.

Yet, assisting in the purchase is only the beginning of ComputerLand's service. If the kit you bought requires a little more do-it-yourself than you yourself can do, we provide assembly assistance.

If that complex program proves to be just that, we provide programming assistance.

And if your system breaks down, our in-store service department will get you back up and running.

Right now!

Great Selection.

Your first stop at ComputerLand may well be your last stop.

ComputerLand offers the finest quality and largest selection of all the major brand names. Like Apple Computer, Cromemco, DEC, Diablo, Hazeltine, ICOM, IMSAI, Lear Siegler, National Semiconductor, North Star, Texas Instruments, Vector Graphics and more.

Plus a complete inventory of tools, books and accessories.

What's more, at ComputerLand, we deal in product. Not promises. Our inventory is on our own shelves. Rather than the manufacturer's. So you can take delivery on tomorrow's components today.

Which means, simply put, that at ComputerLand, you get exactly what you want.

Exactly when you want it.



Be Our Guest.

Begin with the grand tour of our exhibit areas. "Test-drive" any of our individual systems.

Then tell us your needs. We'll sit down and talk about the system that's right for you. It's as easy as that at ComputerLand.

The great computer store. RATED G.

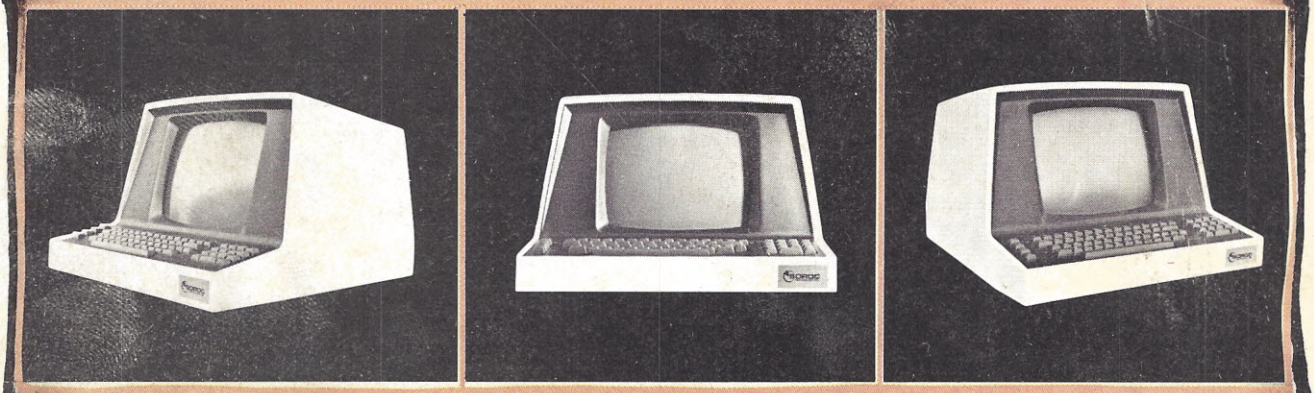
Call or write for the address of the ComputerLand store nearest you. Franchise opportunities available.

ComputerLand™

14400 Catalina St., San Leandro, CA 94577 (415) 895-9363

CIRCLE 2

WANTED



IQ 120

DESCRIPTION

- Lower Case
- Tabbing
- Dual Intensity
- 24 Line x 80 Char.
- Numeric Pad
- Auto Repeat
- Aux. Port
- Optional Printer Port & Block Mode
- Protect Mode
- 15 Baud Rates
- Addr. Cursor

at $995.00 the

SOROC IQ 120 is the most wanted terminal on the market.

For information concerning the REWARD contact···

SOROC TECHNOLOGY, INC.
165 FREEDOM AVE., ANAHEIM, CA 92801
714·992-2860 / 800·854-0147

CIRCLE 3